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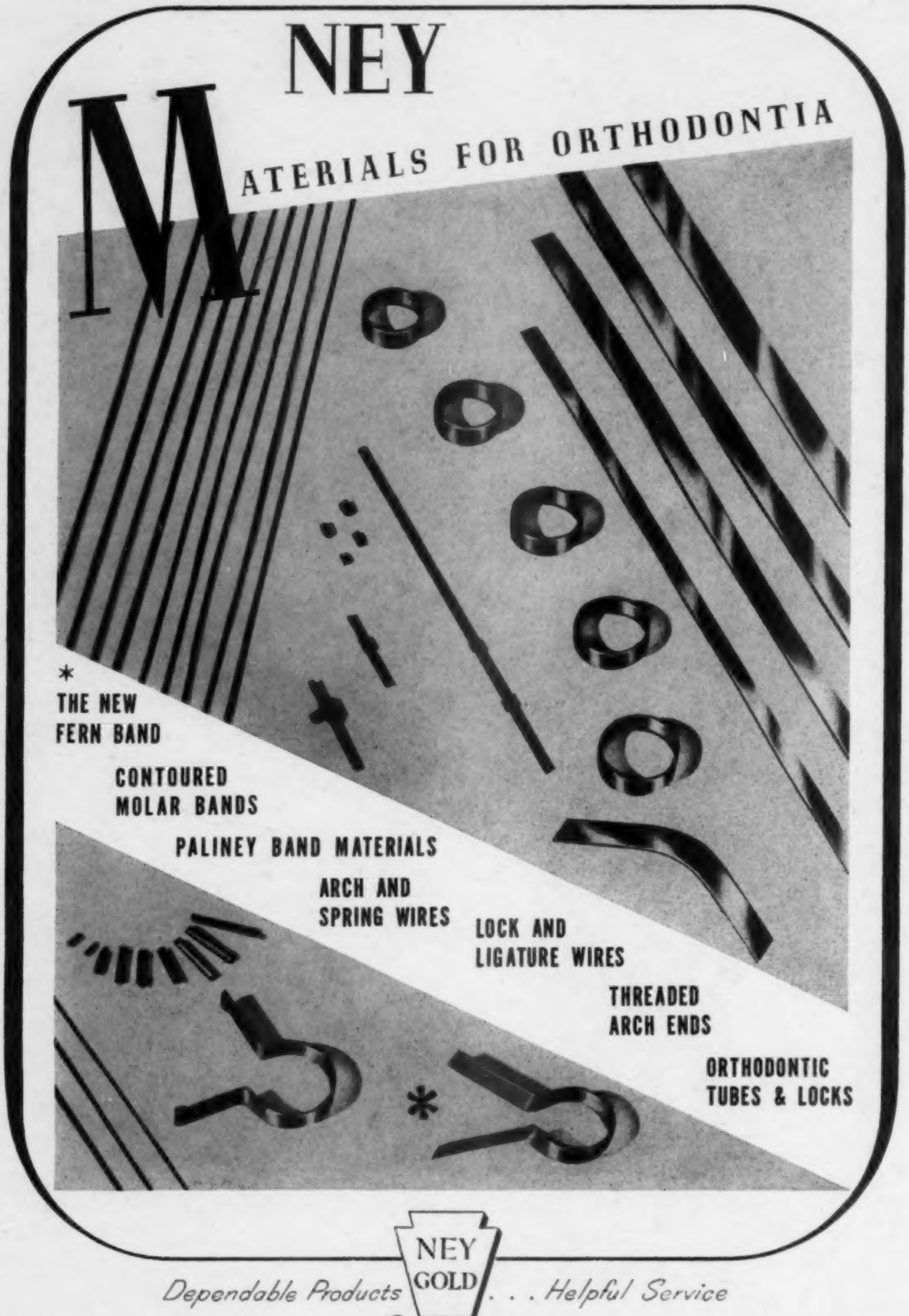

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Original Articles

THE APPLICATION OF ENGINEERING METHODS TO ORTHODONTICS

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INTRODUCTION

THE application of engineering methods to orthodontic problems is not new, and many attempts were made in the past to standardize the therapeutic procedures on a scientific basis. These earlier attempts met with a great deal of opposition on the grounds that the orthodontic problems are basically biologic and not mechanical in character. Today it is generally accepted that, while the orthodontists' problems have a biologic background, the therapeutic measures are entirely mechanical in nature.

If we consider that the object of any orthodontic interference is to change the abnormal relationship of the teeth and the jaws to a normal relationship, then it will become clear that this change in relationship is actually a change in position, and, as such, it represents motion. But motion cannot take place without the application of a force; therefore, all corrective procedures require that forces be applied to change the positions of the teeth. The application of a force is a problem in mechanics, and thus it follows that the problems in orthodontics are mechanical in nature. There is one factor, however, which differentiates the orthodontic problem from other problems in mechanics. The teeth are firmly fixed in the jaws and a change in tooth position implies a change in bony supports. The applied force may be a push or a pull, and, depending on the direction of the force, the tissues on one side of the moving tooth are compressed and put under tension on the opposite side. On the compression side, the bone is absorbed, while on the tension side new bone is deposited. It is not important or necessary to describe the histologic changes within the bone, or the rearrangement of its inner architecture; it is sufficient to recognize that a change in tooth position is always accompanied by resorption in front and by deposition behind the moving tooth. The resorption and deposition of bone accompanying tooth movement represent the biologic aspect of the orthodontic problem in a limited sense. There are other biologic factors involved, but their inclusion at this time would only complicate this presentation. It is sufficient to explain

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that the characteristic change in the position of a tooth in response to an applied force is made possible by the inherent ability of bone tissue to resorb and rebuild under the influence of positive or negative pressure stimuli. The aim of the orthodontist is to bring about tooth movements by mechanical means, and to keep the pressure stimuli within physiologic limits.

The mechanical procedure presupposes a knowledge of normal form. The correlation of the existing abnormal form and the normal form determines the direction and amount of the required tooth movements. The mechanical appliances must be so designed as to bring about the indicated changes. Thus, it appears that the mechanical phase of orthodontics may be divided into three distinct groupings:

1. The study of normal form.
2. The correlation of the abnormal and normal forms.
3. The study of mechanical devices used for the correction of abnormalities.

THE STUDY OF NORMAL FORM

In order to be able to undertake the correction of a dental abnormality, it becomes necessary to form a clear picture of the new form we wish to establish. Without this, it would not be possible to state what changes should be brought about.

The teeth are arranged in a graceful arch in each jaw. This arch of the teeth is referred to as the "dental arch." There is an upper dental arch and a lower dental arch, which have a definite relationship to each other. The upper dental arch is contained in the upper jaw, the maxilla, and it is called the maxillary arch, while the lower arch is contained in the lower jaw, the mandible, and is referred to as the mandibular arch. The maxillary bone is fixed, and the movable mandible performs the function of mastication upon it. In order to function efficiently, a majority of the mandibular teeth must maintain contact with the maxillary teeth during slight mandibular movements. That this condition exists is shown by the wear of the teeth. If only one or two teeth were in contact during mastication, only those teeth would show signs of wear. We know that as time passes on every tooth in the mouth shows signs of wear. This would be possible if the dental arches were arranged on a plane surface. Fig. 1 shows, however, that the masticating surface, or the occlusal surface, is curved with the convexity of the maxillary arch downward. This observation leads to the theory of "spherical occlusion," which means that the function of mastication tends to take place on the surface of a sphere. Function forces the teeth to arrange themselves roughly on the surface of a sphere. This is in conformity with the well-established biologic principle that "form is determined by function." Fig. 2 shows that the front, or anterior, teeth are arranged along a curve which resembles a circle, while the back or posterior teeth are nearly on a straight line. This suggests that the entire dental arch is made up of sections of a sphere (Fig. 3). If in Fig. 4 we let the large circle represent the plan view of the occlusal sphere, and the small circle represent the section of the sphere which forms the anterior portion of the dental arch, then at least one tooth in the posterior part of the mouth is also situated on that sectional

plane. The point commonly known as the buccal groove of the first molar was selected to be on that plane because the teeth beyond that point appear to be situated on another sectional plane. The posterior portions of the arches are arranged along sections which are great circles of the occlusal sphere. Here

Fig. 1.

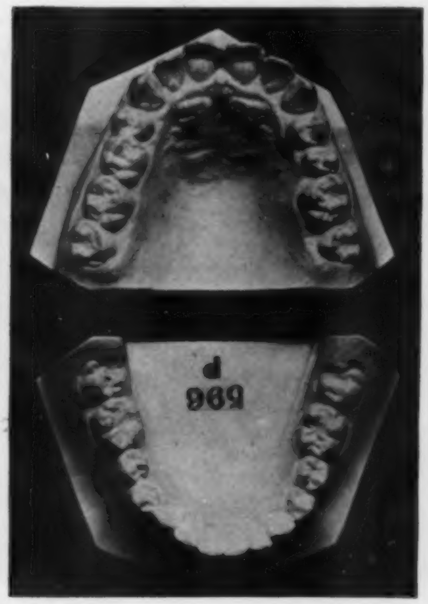


Fig. 2.

Fig. 1.—Normal occlusion (Broomell). (From Angle, E. H.: Malocclusion of the Teeth.)

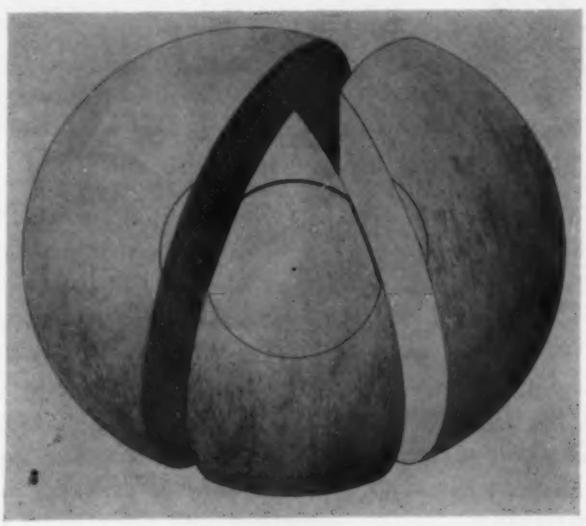


Fig. 3.

we have an explanation of the particular arrangement of the teeth, and this explanation is useful in solving some of the complex problems confronting an orthodontist. If we accept the theory of spherical occlusion, then we may devise a method by which we can predetermine the final shape of the corrected

arch of an individual, with a reasonable degree of accuracy. It is not important to know the exact form, but there should be no question regarding the type of the individual. Dr. Percy Norman Williams sent an identical set of artificial teeth to a number of dental authorities, with the request that they set up those teeth in wax, in what each believed to be the normal arch. Fig. 5 shows how these authorities differed. According to this it makes a very great difference who treats an orthodontic patient, if the shape of the final arch is left to individual judgment. Fortunately we have a method of arch predetermination that eliminates errors due to personal concept.

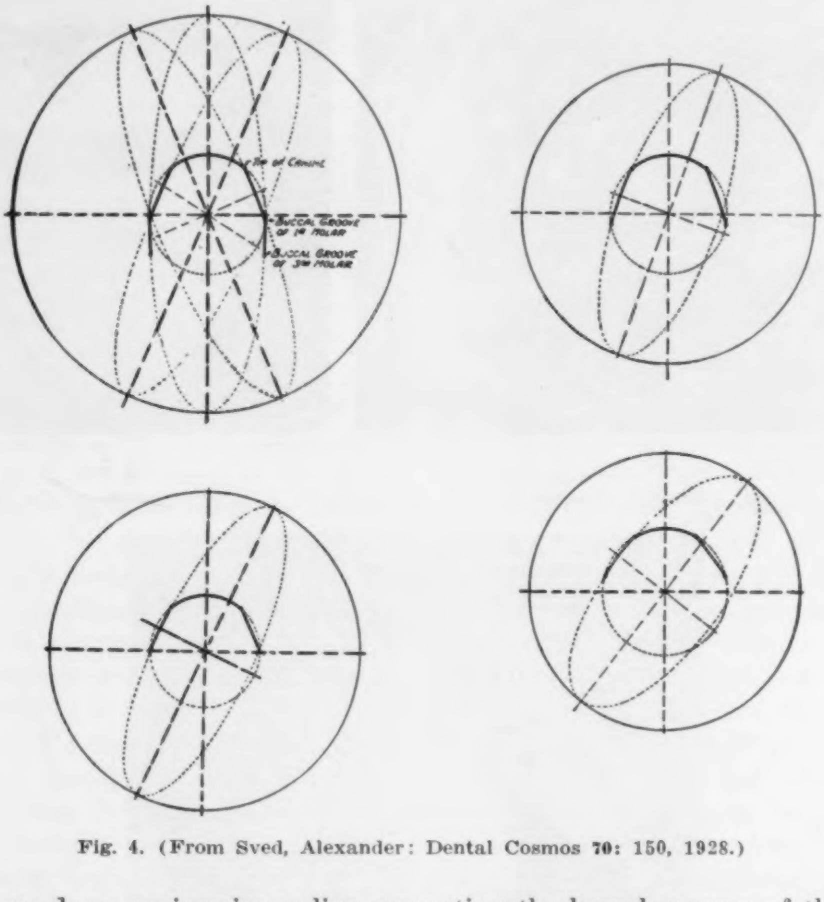


Fig. 4. (From Sved, Alexander: Dental Cosmos 70: 150, 1928.)

If we draw an imaginary line connecting the buccal grooves of the right and left first molars, we obtain the "molar line" (Fig. 6, *A*). Upon examination of a large number of arches it was found that the angle made by the molar line and the posterior line varies widely in different individuals. This angle is the characteristic angle. The posterior line is the line connecting the tip of the canine with the buccal groove of the first molar. This is taken to be a straight line but in reality it is slightly curved, being a projection of a great circle of the occlusal sphere.

The character of an arch is determined by the characteristic angle. Individuals having a long narrow arch have a large characteristic angle. The

broader the dental arch the smaller the characteristic angle. (Fig. 6, *B*.) The character of the arch has nothing to do with size, so that an arch which appears to be broad may actually be narrower between the first molars than another arch which appears to be long and narrow and has a large characteristic angle.

It was found that the characteristic angle is constant and does not change in an individual during growth (Fig. 7). In other words as the arches grow in size the characteristic angle remains constant. It follows, therefore, that this angle can be measured on any individual before beginning treatment, and with that additional information it is possible to predict very closely the probable shape of the finished dental arches after treatment.

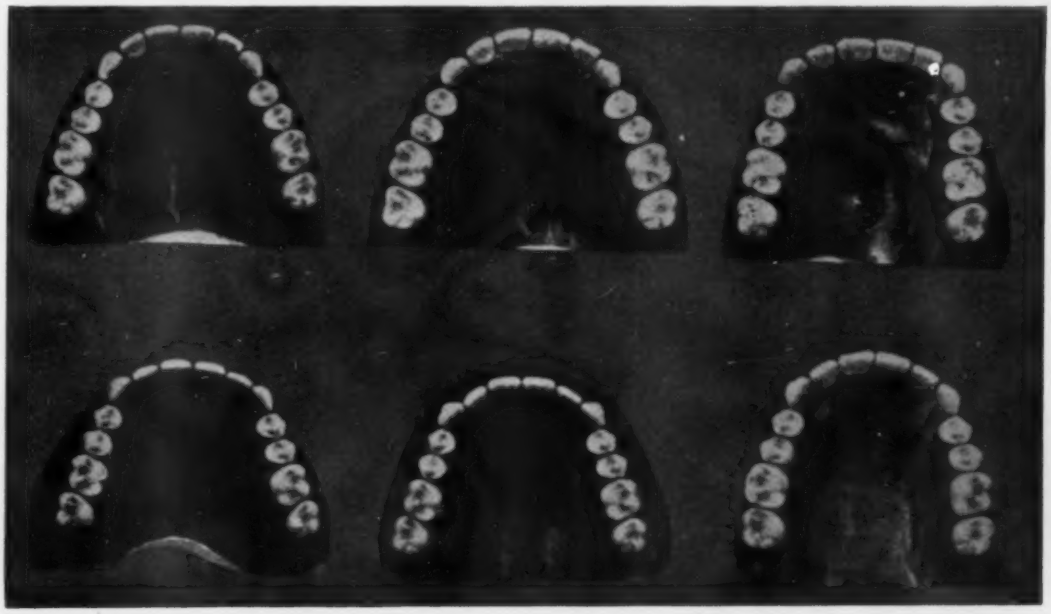


Fig. 5.—Williams, P. Norman: Dental Cosmos 59: 695, 1917.

If a line is drawn from the tip of the canine on one side parallel to the posterior line on the other side we obtain an isosceles triangle whose base is equal to the difference between the molar width and canine width (Fig. 8). The base angles of this triangle are equal to the characteristic angle, and the two equal sides have the length of the posterior lines. If the canine and molar widths of the arch were known it would be a very simple matter to reconstruct the normal arch outline. It is not possible to calculate the molar width mathematically, on account of insufficient given conditions. For this reason the following approximation is offered, which will be close enough for all practical purposes.

If the molar width is represented by W, the canine width by C, and the difference between them by D then:

$$W = C + D$$

In other words, the molar width can be calculated if C and D are known. Now D can be measured directly as will be shown later, but the value of C must be

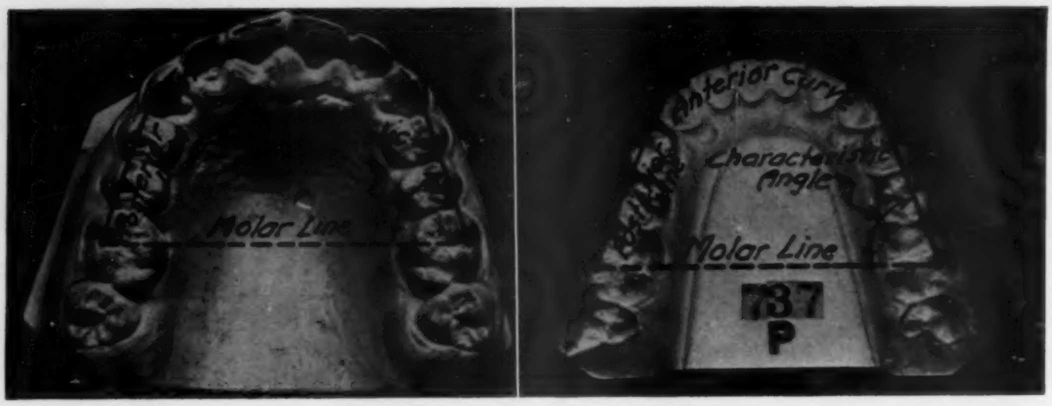
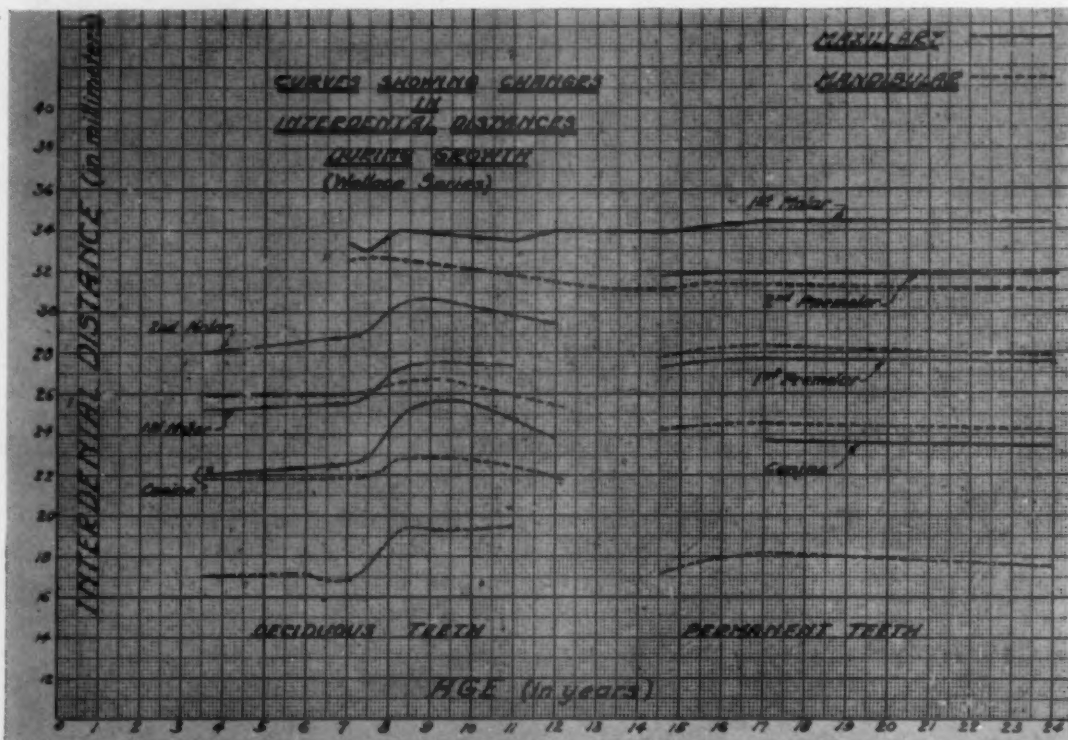


Fig. 6A.

Fig. 6B.



Curves showing changes in interdental distances during growth.

Fig. 7. (From Sved, Alexander: INT. J. ORTHODONTIA 21: 1015, 1935.)

estimated from the known fact that the length of a chord is always less than the subtended circular arc. The canine width C is the chord of the anterior curve, and the length of the anterior curve can be determined by measuring the anterior teeth. If U represents the sum of the mesiodistal diameters of the central incisor, lateral incisor, and mesial half of the canine, then 2 U represents the length of the anterior curve. Accordingly,

$$C \text{ is less than } 2U$$

or

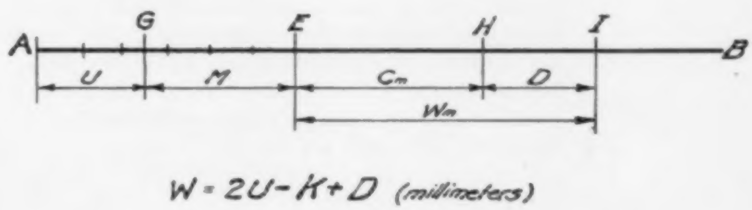
$$C = 2U - k$$

where k is some constant value depending on the size and type of the arch. Therefore, the expression for the molar width will take the form:

$$W = 2U - k + D$$

where k varies with the case under consideration from 2 to 6 mm. On average value k = 3 mm. would be closer, but from experience we know that it is better to allow an extra millimeter in width, so that in my practice I use the formula:

$$W = 2U - 2 + D$$



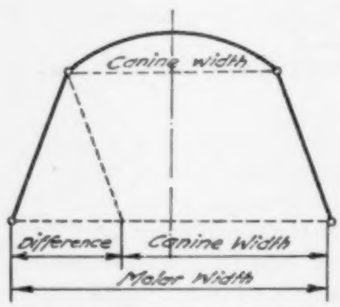


Fig. 8. Fig. 9.

Fig. 8. (From Sved, Alexander: AM. J. ORTHODONTICS AND ORAL SURG. 24: 635, 1938.)

Fig. 9.—Diagram showing construction of individual arch form. (From Sved, Alexander: AM. J. ORTHODONTICS AND ORAL SURG. 24: 635, 1938.)

This gives sufficient room to arrange the teeth during treatment. After the appliances are removed the spaces between the teeth close up very rapidly and the above formula is close enough for all practical purposes. The most important function of this formula is to predict closely the proper type of arch form, which is of immense practical value in practice.

The value of D is determined by the condition previously given that the "growth of a part takes place parallel to itself." Because of this parallel growth the difference between the canine and molar widths is the same in normal occlusion and in malocclusion. Therefore, D is determined by taking the difference between the molar width and the canine width regardless of the condition of occlusion.

The method here given for determining the approximate value of the arch width enables us to predetermine the characteristic arch form of the individual, with a precision consistent with our demands.

The following procedure is suggested (Fig. 9).

1. Draw any line AB and mark A as the starting point.
2. Measure the mesiodistal diameters of all teeth from central incisor to the buccal groove of the first molar. As each measurement is taken, mark it off successively on the line AB in regular order. The length of the line AE represents the sum of the mesiodistal diameters of all the teeth included between the median point and the buccal groove of the first molar on one side.
3. Measure the mesial half of the canine and mark it off from the mesial end of the canine measurement on line AE. Then measure the distal half of the canine and mark it off from the distal end of the canine measurement on the line AE. If these measurements are accurately made, the two points thus obtained coincide. This point represents the position of the tip of the canine, and label it G.
4. Measure AG and GE in millimeters and find

$$U = AG$$
$$M = GE$$

5. Measure the canine width C_m on the model of malocclusion and lay it off on line AB from E to H. Measure the molar width W_m on the same model and lay it off on line AB from E to I. The distance from H to I is equal to the difference between the molar width and the canine width. Therefore $D = HI$. Measure this distance in millimeters.
6. Calculate the normal molar width of the arch by using the formula:

$$W = 2U + D - k$$

7. Draw a line JL equal in length to the calculated width of the arch. Then the points J and L represent the position of the buccal groove of the right and left first molars in normal occlusion.
8. Mark off the distance JN and LO equal to the measurement D.
9. With the measurement M as a radius draw intersecting circular arcs from points J and N as centers. Repeat this operation on the opposite side using points L and O as centers. The points P and S thus obtained represent the positions of the tips of the canines.
10. Draw lines JP and LS. These lines are the posterior lines of the normal arch.
11. Construct the perpendicular bisectors of the posterior lines and prolong them until they intersect. The point of intersection T is the center of the anterior curve, which is an arc of a circle.
12. Using T as a center, open the compass to point P, and draw the circular arc PS. If the construction is carried out accurately, the circle will also pass through the points J and L. The form indicated by the heavy line is the predetermined arch form which is different for every individual.

In order to utilize this method of arch predetermination, it becomes necessary to explain how the forms of the metal arches used in the edgewise arch technique can be accurately determined. It is clear that the arch form given by the measurements of the teeth is the ultimate arch form or the arch form of the completed case. Because of the many bands used the dimensions of the arch must be greater during treatment than after the case is completed; therefore, allowances must be made for the spaces taken up by the parts of the appliance. If the molar bands are made of a material 0.006 inch in thickness, and all other bands are 0.003 inch in thickness, then measurement *U* will be increased by approximately 0.5 mm. and the measurement *M* by 0.7 mm. In these additions an allowance of 0.001 inch is made for every cemented surface.

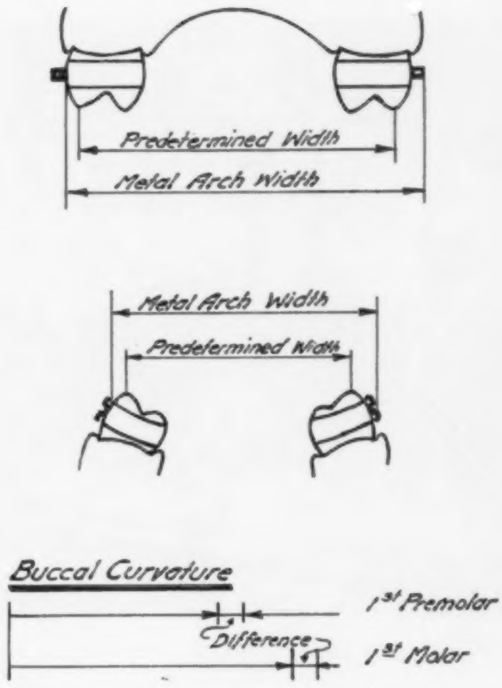


Fig. 10. (From Sved, Alexander: AM. J. ORTHODONTICS AND ORAL SURG. 24: 635, 1938.)

This means that the molar width of the arch is 1 mm. wider during treatment, and for this reason for the predetermination of the metal arch forms the appliance arch form is constructed in exactly the same manner as it was previously described, but using the increased dimensions of *U* and *M*. The measurement *D* can be considered the same without appreciable error. The form of the metal arch is larger than the form indicated by this predetermination, because the arch form is taken along the summits of the buccal cusps of the posterior teeth and the incisal edges of the anterior teeth. (Fig. 10.) Every posterior tooth has a buccal curvature so that the points where the brackets are attached are considerably outside the predetermined form of the arches during treatment. In addition, the metal arches are displaced further buccally and labially by the combined thickness of the cement, the band material, and the bracket. It was found that in the anterior region the radius of

the anterior curve should be increased by 2 mm. on the average, in order to determine the radius of the anterior curve of the metal arch. The variation in different cases is so slight that an average of 2 mm. increase in the radius of the anterior curve is sufficiently accurate. In the posterior region the variation is greater and is measurable after the bands are cemented into position. In order to measure the buccal displacement of the metal arch, draw two straight lines and mark off a starting point on each. Measure the distance between the summits of the buccal cusps of the first premolars by means of a pair of dividers, and lay it off from the starting point of one of these lines. Then place one point of the divider at the base of the bracket on one of the first premolars and measure to the outside of the bracket of the opposite first premolar. Lay this distance off from the starting point of the same straight line.

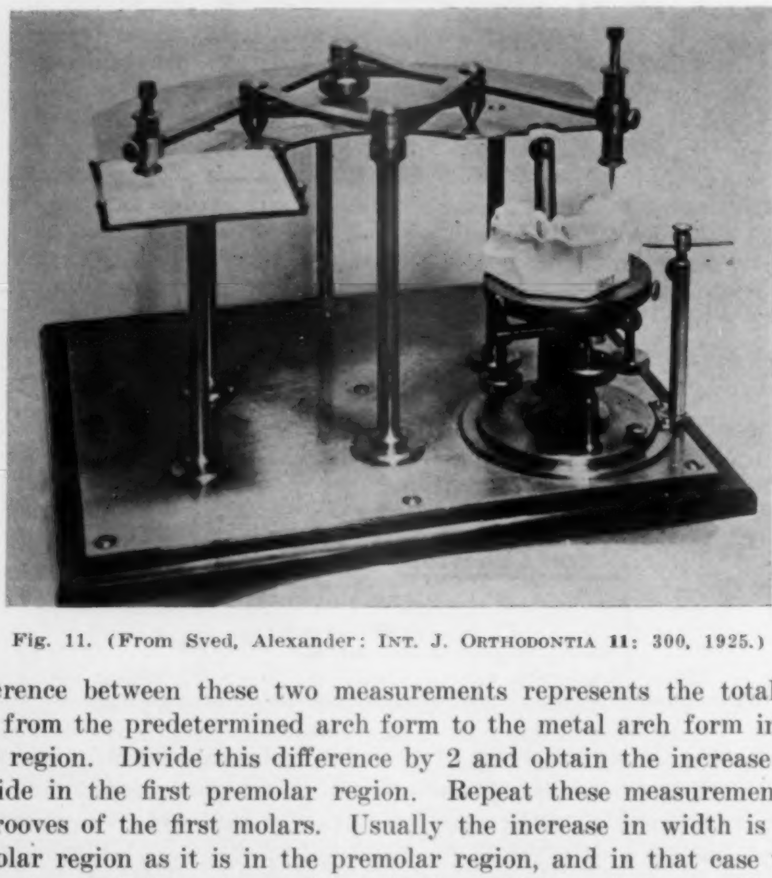


Fig. 11. (From Sved, Alexander: INT. J. ORTHODONTIA 11: 300, 1925.)

The difference between these two measurements represents the total increase of width from the predetermined arch form to the metal arch form in the first premolar region. Divide this difference by 2 and obtain the increase in width on one side in the first premolar region. Repeat these measurements at the buccal grooves of the first molars. Usually the increase in width is the same in the molar region as it is in the premolar region, and in that case the metal arch form is parallel to the predetermined working arch form. If, however, a great difference exists the metal arch is not parallel and proper allowances should be made.

THE CORRELATION OF THE ABNORMAL AND NORMAL FORMS

The method of arch predetermination just described has no diagnostic value in itself. It is an invaluable aid in determining the size and type of the future arches, but it must be properly evaluated in relation to the abnormal arch form. During correction the arch outline is always altered and at the

outset it becomes a problem to determine what changes must be brought about to establish normal relationship. It must be made clear at once that there are no fixed points in the mouth of a growing individual, and there is great variability in the location of identical points in different subjects. For this reason a method had to be devised by means of which the malocclusal and normal occlusal arch outlines may be related to each other, so that the difference between the two arch outlines will indicate the amount and direction of the necessary changes.

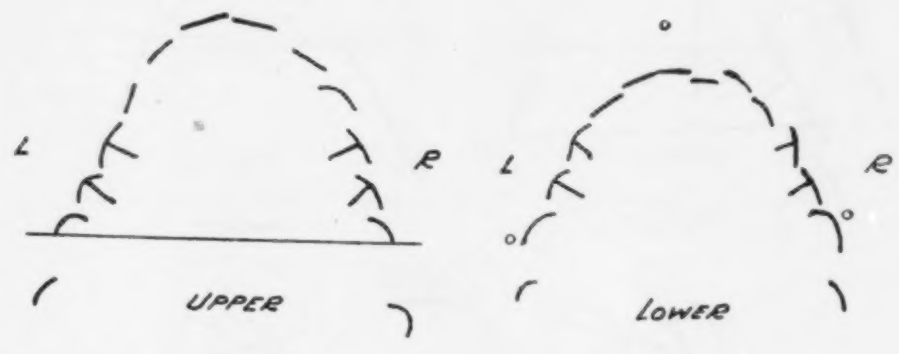


FIG 12

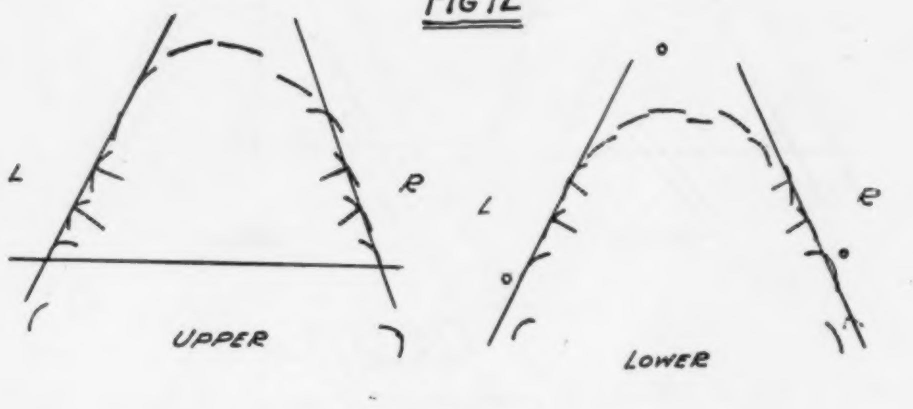


FIG 13

Figs. 12 and 13. (From Sved, Alexander: INT. J. ORTHODONTIA 11: 295, 1925.)

It was shown before that the growth of the dental arches is such that the jaw enlarges parallel to itself. This may not be absolutely true but it is so close to being parallel that it can be so considered without appreciable error. In order to chart the malocclusal condition, an instrument was designed in which the original malocclusal casts can be articulated and charted (Fig. 11). In this instrument provision is made for leveling the occlusal plane when the upper and lower casts are articulated. Before charting the dental arches, the buccal groves of the upper first molars and the median point are projected onto the lower model. These points will appear on the lower chart. The upper and lower dental arches are separately charted and they are related to each other in the following manner.

Fig. 12 represents the charts of the upper and lower dental arches. The latter contains the three points previously projected on the lower model, namely, the buccal grooves of the right and left maxillary first molars, and the median point. A line is drawn on the upper chart to connect the buccal grooves of the first molars. This serves as a reference line.

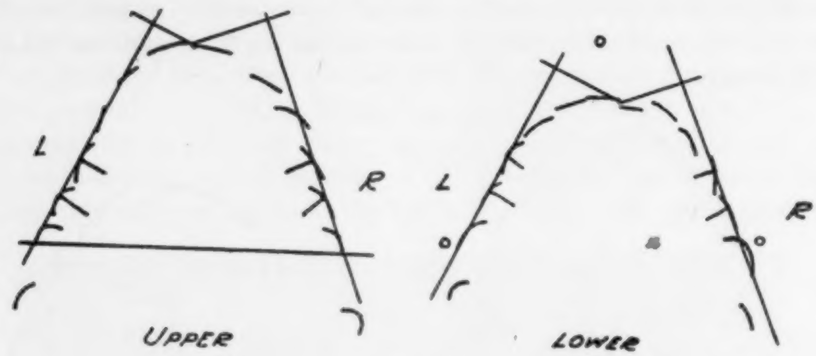


FIG 14

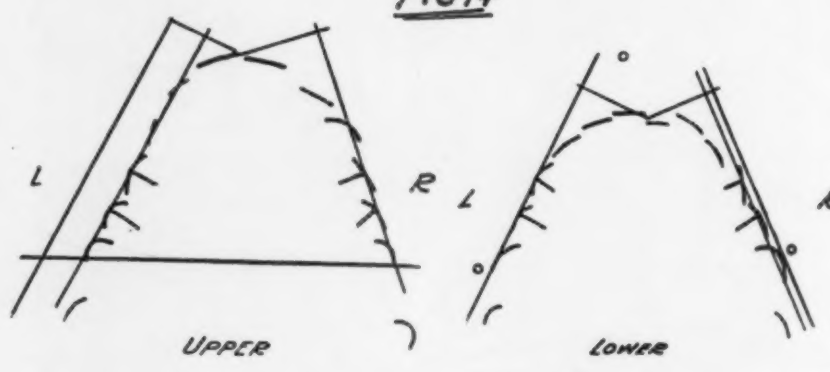


FIG 15

Figs. 14 and 15. (From Sved, Alexander: INT. J. ORTHODONTIA 11: 295, 1925.)

1. Draw a line passing through the buccal cusps of the posterior teeth on both the right and left sides of the upper and lower charts. These lines are the lines of development. (Fig. 13.)
2. The median point is represented by the point of incisal contact between the central incisors. From the median point draw perpendicular lines to the right and left lines of development. (Fig. 14.) The length of these perpendiculars is the measure of lateral development. If they are of equal length, the development is symmetrical. If they are unequal, the longer perpendicular line represents the better developed side. The position of the median point must be observed on the patient. It frequently happens that the premaxillary bone is bent to one side. In that event the correct median point can be located by stretching a dental floss on the median line of the face. This should be marked on the teeth in the mouth and transferred to the model of malocclusion. When chart-

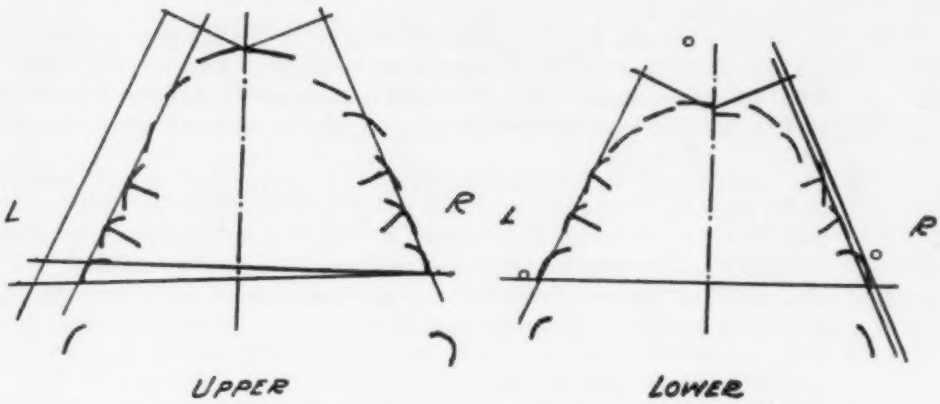


Fig. 16. (From Sved, Alexander: INT. J. ORTHODONTIA 11: 295, 1925.)

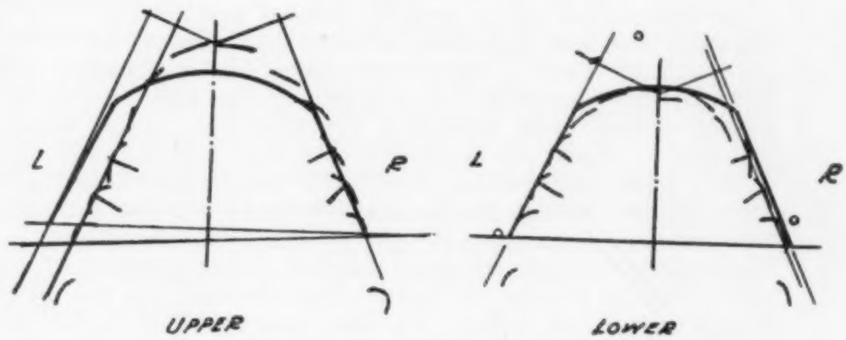


FIG. 17

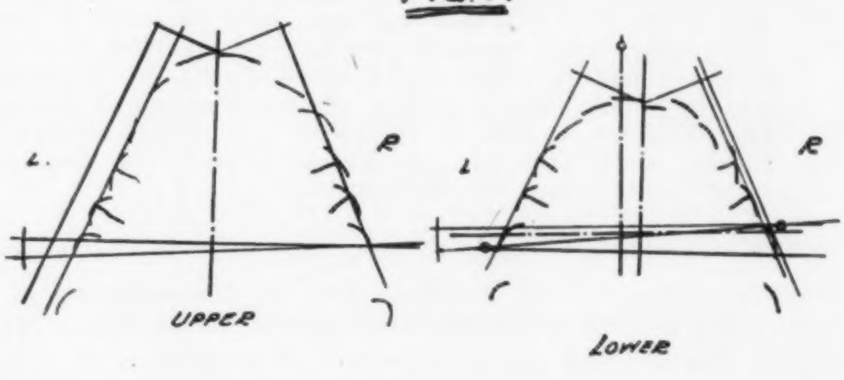


FIG 18.

Figs. 17 and 18. (From Sved, Alexander: INT. J. ORTHODONTIA 11: 295, 1925.)

ing the case, this point should be projected on the upper chart. The lower median point was found by Stanton the most stable point in the entire dentition.

3. In order to make the two sides symmetrical the shorter perpendicular to the lines of development is produced and made equal in length to the longer one. Through the point thus found the "corrected line of development is drawn on the side of lesser development." (Fig. 15.)
4. The permanent first molar on the better developed side is assumed to be in a better position. The molar on the opposite side may or may not be symmetrically situated. Its correct position is located by placing the needle point of the compass on the median point, and striking an arc to cut the corrected line of development with a radius equal to the distance between the better situated molar and the median point. This intersection represents the corrected position of the molar on the least developed side. (Fig. 16.) A line drawn through the better situated molar and the corrected position of the molar on the other side represents a new reference line which must be perpendicular to the median line on the sagittal plane. Therefore, a line drawn through the median point perpendicular to the new reference line is the true median line of the face.
5. After the median line is properly located and the new reference line is established it is a simple matter to draw the predetermined arch outline on the chart, symmetrically about the median line (Fig. 17). The difference between the positions of the teeth indicated by the predetermined arch form and the positions of the teeth on the malocclusal chart represent the direction and amount of the required tooth movements. The tooth movements indicated by this chart are all through the bone and they do not take into consideration the required change in the position of the mandible.
6. To predetermine the required change in the position of the mandible, draw a line on the lower chart through the two points previously projected, which represent the existing positions of the maxillary first molars. This corresponds to the old reference line on the upper chart. (Fig. 18.) By the aid of ruler and compass transfer the new reference line from the upper chart to the lower chart, and draw a perpendicular to that line from the projected maxillary median point on the lower chart. This represents the maxillary median line in relation to the median line of the mandible. The difference in position represents the required change in the position of the mandible. In normal occlusion the maxillary and mandibular median lines must coincide.

STUDY OF THE MECHANICAL DEVICES USED FOR THE CORRECTION OF ABNORMALITIES

The study of the mechanical devices used for the correction of dental abnormalities may be roughly divided into lingual or labial groups. Those belonging to the lingual group are placed behind the teeth, or on the tongue side of the dental arch, while those in the labial group are placed in front of the teeth or on the lip or cheek side of the dental arch. The lingual appliances usually are cantilever in character. They are locked securely to the first permanent molars, and the teeth are moved by means of auxiliary springs. On account of the cantilever arrangement and the inclined planes of the anterior teeth, these appliances lift the first molars from their sockets even if a great deal of care is taken in their adjustment.

These appliances have only a limited application and they are used for special purposes, such as lateral expansion of the arches and the labial or buccal movement of individual teeth. The labial group of appliances are more efficient. They are used in combination of a labial wire with or without bands. The most modern labial appliances require the use of bands on all teeth. These bands serve as a means of support for the different kinds of attachments which receive the labial wire. This arrangement is very efficient and is suited for nearly all the required tooth movements.

Since in a complete appliance there are twelve bands in each jaw there are twelve points at which the elastic arch wire is attached to the teeth. It becomes clear at once that the understanding of the behavior of this wire becomes a complicated problem. The three laws of static equilibrium, namely:

1. Algebraic sum of horizontal components = O
2. Algebraic sum of vertical components = O
3. Algebraic sum of moments = O

fail to give sufficient conditions to find the reactions of the wire at the twelve points of attachment.

I had the pleasure and rare privilege of becoming acquainted with Prof. C. R. Brumfield, who is well known to you. He has developed a new method for the "Solution of Statically Indeterminate Structures by Transmission Coefficients," and he advised me and guided me in the solution of the problem of the elastic arch as used in orthodontics. It was made clear that this problem can be treated, without appreciable error, as a beam with multiple supports, but the usual method of applying the "theory of three moments" could not be used on account of the very large number of simultaneous equations which would have to be solved.

The fundamental concept of "The Transmission Coefficient" is developed from the theory of three moments which may be expressed as follows:

$$1.\quad \frac{M_1L_1}{I_1} + 2M_2\left(\frac{L_1}{I_1} + \frac{L_2}{I_2}\right) + M_3\frac{L_2}{I_2} = -P_1C_1\frac{L_1^2}{I_1} - P_2C_2\frac{L_2^2}{I_2}$$

Where M_1 M_2 M_3 represent the bending moments at the first, second, and third supports

L_1 = left span (first).
L_2 = right span (second).
I_1 = moment of inertia of the section in left span.
I_2 = moment of inertia of the section in right span.
P_1 = load in the left span.
P_2 = load in the right span.

C_1 and C_2 are constants depending upon the loading in the respective spans.

If we let $Q = \frac{L}{I}$ in general,

then $Q_1 = \frac{L_1}{I_1}$ $Q_2 = \frac{L_2}{I_2}$; etc.

then we may write equation (1) in the following form.

$$M_1Q_1 + 2\ M_2\ (Q_1 + Q_2) + M_3Q_2 = -P_1C_1L_1Q_1 - P_2C_2L_2Q_2$$

where $Q = \frac{L}{I}$ the span ratio.

Thus the *span ratio* may be defined as the ratio of the length of any span of a continuous beam to the moment of inertia of that span.

Consider the continuous beam shown in Fig. 19. This beam has an infinite number of spans extending toward the right having span ratios Q_1 Q_2 Q_3 Q_4, etc. Let it be assumed that this beam rests on free supports, and that the spans shown are influenced by a bending moment originating in some span on

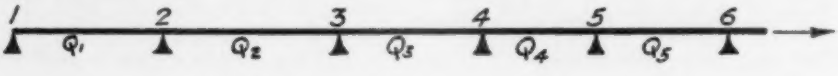


Fig. 19.

the right. Since there are no loads in any of the spans shown in the diagram, the general equation of the theorem of three moments will take the following form for the respective spans.

a. $M_1Q_1 + 2\ M_2\ (Q_1 + Q_2) + M_3Q_2 = O.$
b. $M_2Q_2 + 2\ M_3\ (Q_2 + Q_3) + M_4Q_3 = O.$
c. $M_3Q_3 + 2\ M_4\ (Q_3 + Q_4) + M_5Q_4 = O.$
d. $M_4Q_4 + 2\ M_5\ (Q_4 + Q_5) + M_6Q_5 = O$, etc.

Since according to our assumption the beam ends at a free support $M_1 = O$.

Therefore from equation a $\quad M_2 = - M_3 . \dfrac{Q_2}{2(Q_1 + Q_2)}$

substituting value of M_2 in equation b.

$$M_3 = - M_4 \left[\frac{Q_3}{2(Q_3 + Q_2) - \dfrac{Q_2{}^2}{2(Q_2 - Q_1)}} \right]$$

$$= - M_4 \left[\frac{Q_3}{2\ Q_3 + Q_2 \left\{ 2 - \dfrac{Q_2}{2(Q_1 + Q_2)} \right\}} \right]$$

substituting the above value of M_3 into equation c.

$$M_4 = - M_5 \left[\frac{Q_4}{2(Q_4 + Q_3) - \dfrac{Q_3{}^2}{2(Q_3 + Q_2) - \dfrac{Q_2{}^2}{2(Q_2 + Q_1)}}} \right]$$

$$M_4 = - M_5 \left[\frac{Q_4}{2\ Q_4 + Q_3 \left\{ 2 - \dfrac{Q_3}{2\ Q_3 + Q_2 \left[2 - \dfrac{Q_2}{2(Q_1 + Q_2)} \right]} \right\}} \right]$$

This may be carried on indefinitely and we may write an infinite number of equations having the same form. From the study of these equations it becomes clear that the fraction by which the negative of the moment on the right of any span is multiplied to give the moment at the left of the span, has the same structure. This fraction is known as the "Transmission Coefficient." It will be observed that the Transmission Coefficient of any span is

$$C_n = \frac{Q_n}{2\ Q_n + Q_{(n-1)}\ [2 - C_{(n-1)}]}$$

Where Q_n = span ratio of that span.
$Q_{(n-1)}$ = span ratio of the first span to the left.
$C_{(n-1)}$ = Transmission coefficient of the first span to the left.

It can be readily seen from this expression that the value of C in any span cannot be greater than 0.5 and it may approach zero as a lower limit. Thus:
When

$$Q_{(n-1)} = 0$$

$$C_n = \frac{Q_n}{2\,Q_n} = 0.5$$

When

$$Q_n = 0$$

$$C_n = \frac{0}{0 + Q_{(n-1)}\,[2 - C_{(n-1)}]} = 0$$

If the beam is fixed at the end supports

$$C_n = 0.5$$

If the end of the beam is freely supported, then

$$C_n = 0$$

In the formula

$$C_n = \frac{Q_n}{2\,Q_n + Q_{(n-1)}\,[2 - C_{(n-1)}]}$$

we may divide the Q values by Q_H without changing the value of the fraction. Thus:

$$C_n = \frac{\dfrac{Q_n}{Q_H}}{2\,\dfrac{Q_n}{Q_H} + \dfrac{Q_{(n-1)}}{Q_H}\,[2 - C_{(n-1)}]}$$

The fractions

$$\frac{Q_n}{Q_H},\ \frac{Q_{(n-1)}}{Q_H}$$

represent the Q ratios, where Q_H is arbitrarily chosen to be the highest span ratio. It is more convenient to use the Q ratios in all calculations. Therefore

$$C_n = \frac{q_n}{2\,q_n + q_{(n-1)}\,[2 - C_{(n-1)}]}$$

where $q = Q$ ratio.

The torque at any support is split, and part of it is transmitted to the right of the support and the remainder to the left of it.

The term $Q_n\,(2 - C_n)$

is known as the stiffness index and it may be represented by the symbol R_n.
The torque split at any support may be calculated by the formula

$$T_n = \frac{1}{R_n\left[\dfrac{1}{R_n} + \dfrac{1}{R_{(n+1)}}\right]}$$

from left to right and right to left of the support, and the torque splits in the two directions must equal unity.

In order to calculate the forces delivered by the wire to the teeth we may assume that one of the supports is displaced $\frac{1}{100}$ of an inch from its passive position. This sets up a torque at that support which is split into

T_L = to the left
T_R = to the right of the support

acting in the clockwise and counterclockwise directions, respectively.

The elastic curve of the wire makes angles Θ_L and Θ_R with its unstressed position, at the adjoining left and right supports, respectively (Fig. 20). Since these are very small angles

$$\Theta_L = \frac{0.01}{\text{span length to left}} \quad \text{radians}$$

$$\Theta_R = \frac{0.01}{\text{span length to right}} \quad \text{radians}$$

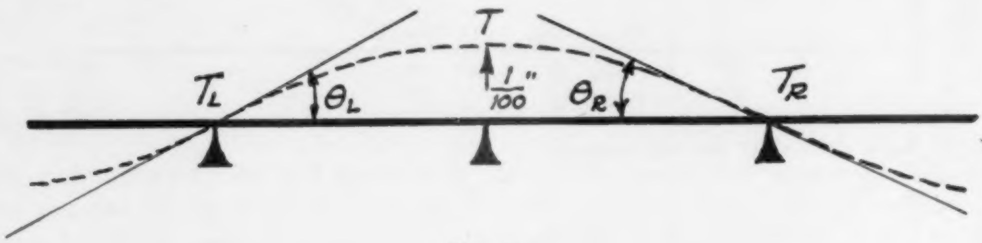


Fig. 20.

From the values of these angles we can calculate the torque at the adjoining left and right supports

$$T_L = \frac{6\ E\ \Theta_L}{Q_L}$$

$$T_R = \frac{6\ E\ \Theta_R}{Q_R}$$

The total torque at the displaced attachment is

$$T = T_L + T_R \qquad \text{(added algebraically)}$$

By assigning proper torque values at the displaced attachment and at the attachments on the right and left of it, the torque may be distributed separately by transmission coefficients.

From the algebraic sum of the moments at each attachment we can calculate the vertical shear at the left support of each span, by adding the moments at the right and left ends of each span, and then dividing it by the span length. Figs. 21 and 22 show the various steps in these calculations.

The table shown in Fig. 23 indicates that more than one pound of force may be delivered to the teeth if the arch wire is deviated $\frac{1}{100}$ of an inch from its passive position at one support. If the displacement is more than $\frac{1}{100}$ of an inch, the reaction of the teeth may proportionately be greater, and if it occurs at more than one attachment, the effects must be algebraically added. This clearly indicates that it is possible to put a pressure of 10 pounds or more on a tooth by means of orthodontic appliances. The table further shows that if the wire is applied edgewise so that b = 0.022 inch and d = 0.028 inch, the pressure on the teeth is increased 73 per cent. It is interesting that the 0.022 by 0.028 inch wire is used in an edgewise manner, and that the most commonly used appliance is named "the edgewise arch applance." It may be further pointed out that if the light gauge round wires are used, the force on the teeth is very much diminished, and the 0.016 inch round wire exerts only 13 per cent of the force exerted by the 0.028 by 0.022 inch flat arch, and only 7½ per cent of that delivered by the edgewise arch. In my own practice I very seldom resort to anything heavier than the 0.016 inch round wire.

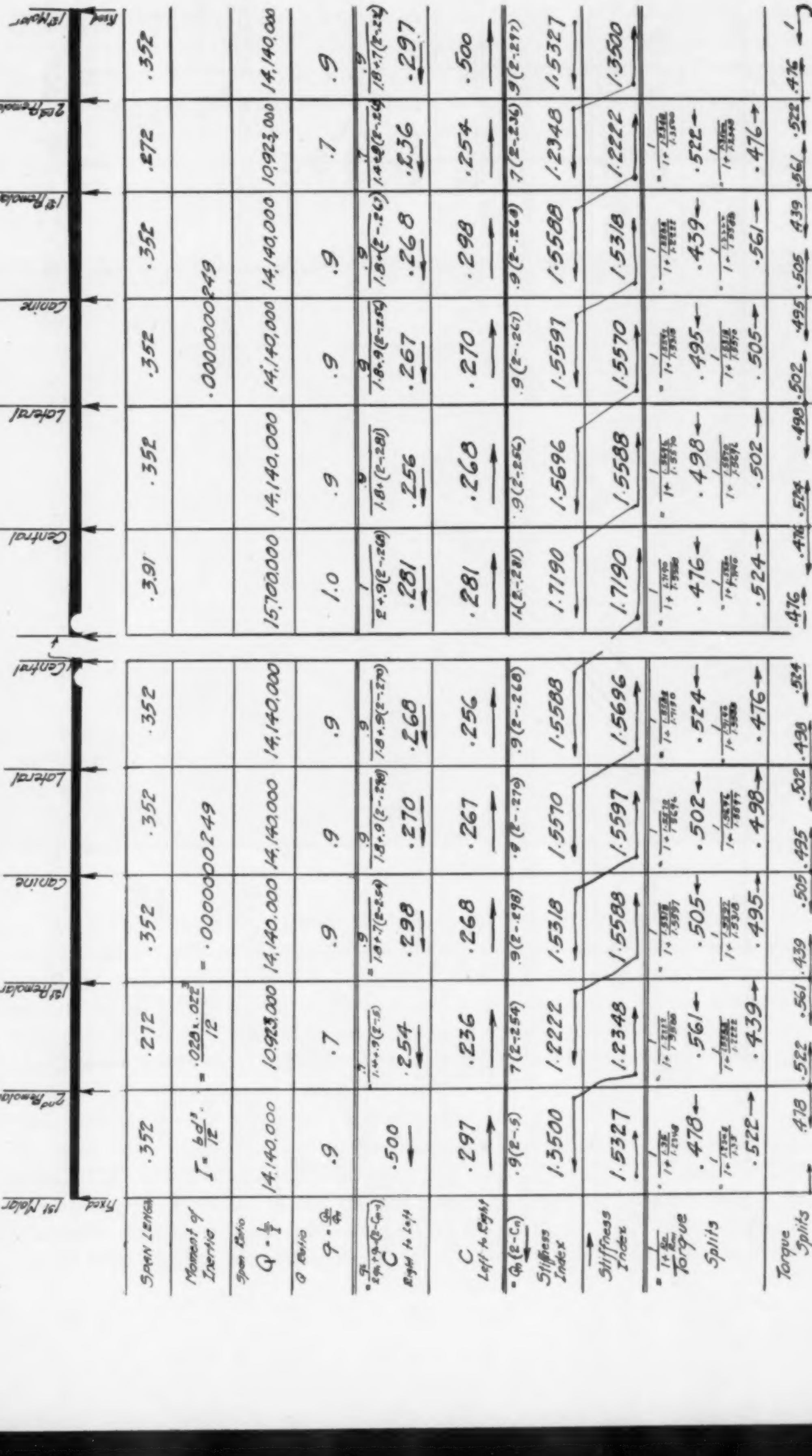

1st Molar
Fixed
2nd Premolar
1st Premolar
Canine
Lateral
Central
Span Length
Moment of Inertia
Span Ratio
Q Ratio
Stiffness Index
Torque Splits

Fig. 21.

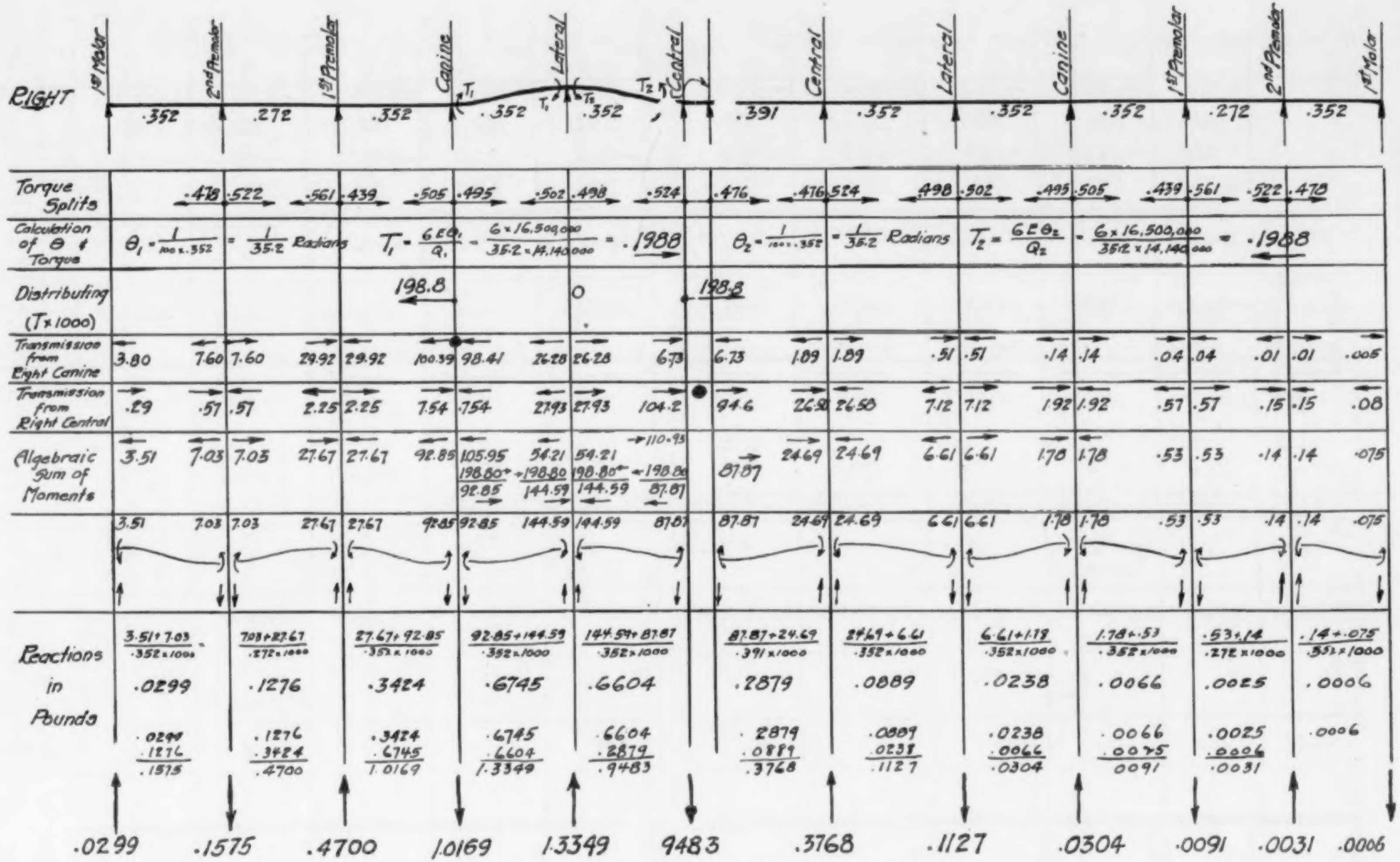

RIGHT
1st Molar
2nd Premolar
1st Premolar
Canine
Lateral
Central
Central
Lateral
Canine
1st Premolar
2nd Premolar
1st Molar
Torque Splits
Calculation of θ & Torque
Distributing (T×1000)
Transmission from Right Canine
Transmission from Right Central
Algebraic Sum of Moments
Reactions in Pounds
.0299
.1575
.4700
1.0169
1.3349
.9483
.3768
.1127
.0304
.0091
.0031
.0006

Fig. 22.

The correctness of these calculations were checked by Professor Brumfield, and by reproducing the conditions under which these figures were obtained, the force necessary to deflect the wire $\frac{1}{100}$ of an inch was measured. In every instance the measured values checked the calculated values except at the end supports. The slight discrepancy at the end supports was due to insufficient fixation. The ends of the wire should have been soldered to the supports instead of just being clamped. Fig. 24 shows the device used for these measurements.

REACTIONS OF TEETH IN POUNDS, CAUSED BY $\frac{1}{100}$ INCH DISPLACEMENT OF WIRE

DISPLACEMENT AT ↓	RIGHT FIRST MOLAR	RIGHT SECOND PREMOLAR	RIGHT FIRST PREMOLAR	RIGHT CANINE	RIGHT LATERAL	RIGHT CENTRAL	LEFT CENTRAL	LEFT LATERAL	LEFT CANINE	LEFT FIRST PREMOLAR	LEFT SECOND PREMOLAR	LEFT FIRST MOLAR
RIGHT FIRST MOLAR	[illegible]	1.1961	[illegible]	.1128	.0308	.0077	[illegible]	.0006	[illegible]	0	0	0
RIGHT SECOND PREMOLAR	1.2008	[illegible]	1.7298	[illegible]	.1582	[illegible]	.0100	[illegible]	.0008	[illegible]	.0001	[illegible]
RIGHT FIRST PREMOLAR	.5644	1.7380	[illegible]	1.1954	[illegible]	.1200	[illegible]	.0073	[illegible]	.0007	[illegible]	0
RIGHT CANINE	.1122	[illegible]	1.1934	1.4016	1.0166	[illegible]	.1022	[illegible]	.0081	[illegible]	.0009	[illegible]
RIGHT LATERAL	[illegible]	.1575	.4700	1.0169	[illegible]	.9483	[illegible]	.1127	[illegible]	.0091	.0031	.0006
RIGHT CENTRAL	.0077	[illegible]	.1208	[illegible]	.9458	[illegible]	.8470	[illegible]	.1002	[illegible]	.0098	.0020
LEFT CENTRAL	.0020	.0098	.0286	.1002	[illegible]	.8470	[illegible]	.9458	[illegible]	.1208	[illegible]	.0077
LEFT LATERAL	.0006	.0031	.0091	[illegible]	.1127	[illegible]	.9483	[illegible]	1.0169	[illegible]	.1575	[illegible]
LEFT CANINE	.0002	.0009	[illegible]	.0081	[illegible]	.1022	[illegible]	1.0166	[illegible]	1.1934	[illegible]	.1122
LEFT FIRST PREMOLAR	0	.0002	.0007	[illegible]	.0073	[illegible]	.1200	[illegible]	1.1954	[illegible]	1.7380	[illegible]
LEFT SECOND PREMOLAR	0	.0001	[illegible]	.0008	[illegible]	.0100	[illegible]	.1582	[illegible]	1.7298	[illegible]	1.2008
LEFT FIRST MOLAR	0	0	0	[illegible]	.0006	[illegible]	.0077	.0308	.1128	[illegible]	1.1961	.7246

RELATIVE REACTIONS OF DIFFERENT SIZE WIRES

SIZE → IN THOUSANDS OF AN INCH	22×28	28×22	22	20	18	16
RATIO	1.00	1.73	.46	.32	.21	.13

Occlusal Gingival

Fig. 23. (From Sved, Alexander: INT. J. ORTHODONTIA 23: 683, 1937.)

It is also important to mention that these figures are based on knife-edge supports at the attachments. The standard edgewise arch attachment is a finely machined lock, and in addition to the calculated forces secondary reactions are set up, which can only add to the already too great forces. I have discussed this with Professor Brumfield and with his help a new attachment with knife-edge supports was evolved (Fig. 25), which, in combination with a 0.016 inch round wire, represents the most gentle orthodontic appliance in use. I have used that combination for more than fifteen years with very great satisfaction.

There are other phases of orthodontic practice which may better be understood by resorting to engineering methods. The problem of diagnosis falls into this category. I regret to say that at present many orthodontic patients are treated to conform to some preconceived notion, and on the strength of vaguely defined relationships the extraction of four or more sound teeth is recommended.

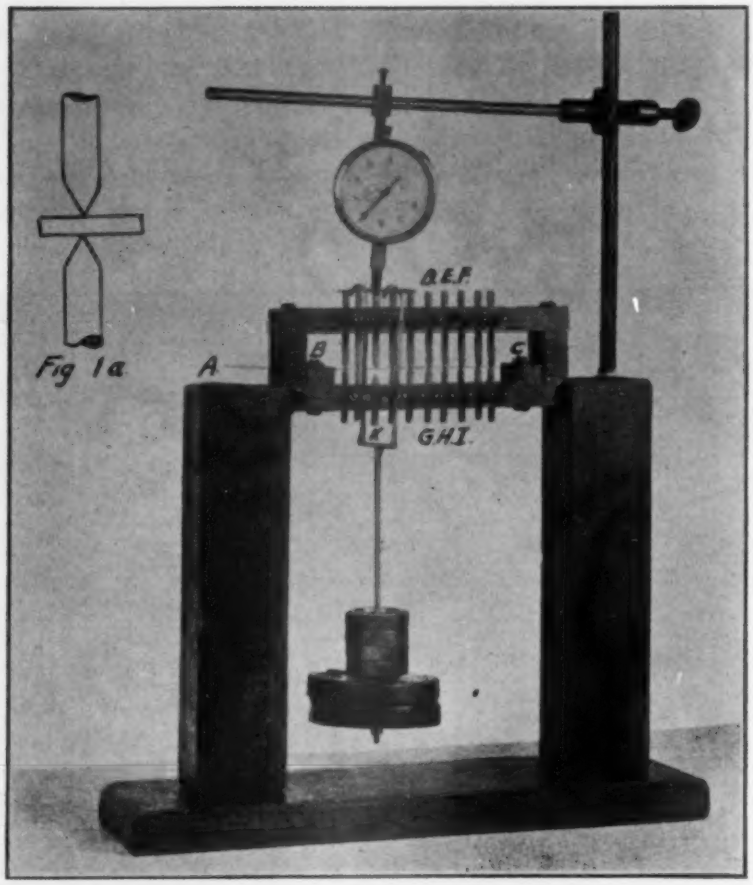


Fig. 24. (From Brumfield, C. R.: INT. J. ORTHODONTIA 23: 687, 1937.)

Fig. 25. (From Sved, Alexander: AM. J. ORTHODONTICS AND ORAL SURG. 24: 635, 1938.)

I cannot accept the teaching that the development of the face of a child is nearly completed at the onset of puberty; and for this reason we cannot evaluate the dentition of a growing child by adult standards. The face of an adolescent is always more protrusive than that of an adult. This is due to the fact that the teeth contained in an adolescent's mouth actually belong to a mature adult and, therefore, are too large to be properly accommodated.

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WHAT DOES EXTRAORAL ANCHORAGE ACCOMPLISH?

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INTRODUCTION

The problem of anchorage is a major concern of every thoughtful orthodontist. Early in his student life, he begins learning about the various types of anchorage: simple, reciprocal, stationary, intermaxillary, and occipital. As he applies his knowledge, first in the clinic, later in his practice, he continues learning the lessons of anchorage that only experience can teach. Daily he observes the operation of that relentless law of physics: To every action there is an equal and opposite reaction. He learns from sad experience, as no written or spoken words can convey, that what is conceived and planned to be stationary anchorage sometimes proves disappointingly unstable, that even when all the teeth of one dental arch are combined securely as a unit of anchorage for intermaxillary force, they may move in an unfavorable direction as a result of the pressures that are intended to move only the teeth of the opposite arch. He learns how much more easily teeth are moved forward or mesially than backward or distally, and so he may come to distrust, or at least to question the absolute stability of the teeth as anchorage, and turn to extraoral anchorage when he wishes to exert a force that will not disturb teeth other than those he would move.

HISTORICAL BACKGROUND

Until the principle of mesiodistal intermaxillary anchorage was introduced in 1893, occipital anchorage had been the accepted means of securing distal movement of teeth in both Class III malocclusions and in Class II, Division 1 or Class I cases with protruding upper incisors. J. S. Gunnell is credited by Weinberger[6] with having first used the chin cap together with a headcap in the year 1822 to treat a Class III case. Incidentally, it is interesting to note in passing that as early as 1802 the chin cap was used as anchorage by Cellier, not for orthodontic movement, but "to prevent accidents from happening in the extraction of teeth."[6]

In 1855 Norman Kingsley first used occipital anchorage to retract protruding upper incisors. He also used an ingenious device connected with the headcap for depressing these anterior teeth when they were elongated. Kingsley made further use of the headcap to extrude as well as retrude lower incisors in open-bite cases of Class III malocclusion.[7]

Calvin S. Case used occipital anchorage to exert a retruding and intruding force upon upper labial teeth, a retruding and extruding force upon lower labial teeth, and a distal force upon the buccal teeth. After he began the use of intermaxillary force, he continued using the headcap as an adjunct. To quote from his book, *Dental Orthopedia and Cleft Palate*,[2] "In this connection the

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occipital apparatus is especially valuable as an auxiliary to the intermaxillary force. By this means . . . the two retrusive forces can act upon the most distal upper molars, or all of the buccal teeth without exerting any force, if not desired, upon the labial teeth. In fact the incisor teeth can be moved labially from the molar anchorages while the premolars and molars are moved distally with the occipital and intermaxillary forces to open spaces for the eruption of crowded cuspids.''

In the seventh edition of *Malocclusion of the Teeth,* Edward H. Angle[1] illustrates and describes his headcap and the various attachments he devised for the use of occipital anchorage in the treatment of Class II, Division 1 cases. He states, however, ''Notwithstanding the great efficiency of this appliance, the present demands of orthodontia are best fulfilled in these cases by the Baker form of intermaxillary anchorage . . . by means of which extraction is avoided and normal occlusion established instead of merely 'improved' occlusion as in the former plan of treatment. For this reason this appliance has been superseded in the author's practice, and though it may occasionally be used as auxiliary to intermaxillary anchorage, yet the necessity for its use will become lessened as greater skill in the employment of intermaxillary anchorage is developed.''

It is easy to understand why the headcap was discarded by most orthodontists after the introduction of intermaxillary anchorage, which was naturally and rightly hailed as a great stride forward in the development of appliance therapy. For forty years or more, occipital anchorage was seldom used, until Albin Oppenheim[3, 4] revived its use in the 1930's. He mentioned using the headgear and traction bar for distal movement of maxillary posterior teeth in the JOURNAL in 1934 in a series of articles called ''The Crisis in Orthodontia,'' and again in the *Angle Orthodontist* in 1935 and 1936 in connection with a report of his studies of tissue reaction in response to orthodontic pressures. When Dr. Allan G. Brodie returned from Europe in the late summer of 1936 he reported to his students Dr. Oppenheim's method and the success he had in distal mass movement of upper teeth, using a heavy labial arch applied to two molars at night only, with pressure from a headcap.

Dr. Oppenheim[5] says the use of the headcap in this manner was the result of a lucky chance when ''an actress with greatly protruding teeth, a Class II case with the chin in normal position (upper protraction) came to his office. The upper teeth needed to be brought back. The whole complement of teeth was present. The use of the head cap was suggested so as not to interfere with her professional duties. The suggestion was accepted. The patient came to the office several times at short intervals complaining about soreness of the teeth, impossibility of chewing, and sleeplessness from pain. Each time the force was diminished, and then she did not appear again. Believing that she was loath to continue the treatment, the author was astonished when she reappeared several months later; and what had happened? The teeth had ceased to be sore so she had conscientiously worn the head cap during the months of her starring performances all over Europe. On her return, all the buccal teeth, formerly in Class II relationship, were now in end-to-end bite with no spaces

between them except between the first premolars and canines. The treatment was continued with new rubbers (the original pair of rubbers having been worn all the months through) till normal interdigitation was obtained. Thus, a new way for the use of the head cap had been found; previously it was recommended and used only for reinforcing anchorage."

Although Oppenheim credited the use of this method to luck, it is a clinical verification of his laboratory research findings. His microscopic studies of sections of human teeth and alveolar bone following the application of orthodontic forces of varied degrees and duration had convinced him that gentle forces intermittently applied between short periods of rest not only move teeth most effectively, but also move them with the least damage to the roots and investing tissues.

After Dr. Oppenheim published his findings in the *Angle Orthodontist* in 1935 and 1936, a few of us tried the headcap in the manner he described, but it was not until after he came to the United States a few years later that extraoral anchorage became at all popular. Its use has increased gradually, more cases have been presented in meetings, and more reports have been published, until extraoral anchorage occupies a respected place in orthodontics and the orthodontist who uses it for tooth movement is no longer considered eccentric, as Dr. Oppenheim was thought by many to be. It seems sad to me that this gentle, sincere, and truly great man could not have lived to see the wide acceptance of his views on the method which is the closest approach to biologic tooth movement.

In answering the question posed by the title of this paper, we shall not dwell unduly on the obvious fact that extraoral anchorage is the only type of anchorage which is completely stationary and therefore does not produce reactionary movements of other teeth as a result of its action on the desired teeth. We shall develop five other points in its favor.

1. As a means of increasing or decreasing arch length.
2. As a means of changing mesiodistal relationships of upper to lower teeth.
3. As an auxiliary to intraoral anchorage.
4. As retention after tooth movement.
5. The advantages of applying gentle intermittent forces.

There is abundant evidence in the literature of increased arch length obtained by the use of the headcap, either by applying the force to two molars only, or to small groups of buccal teeth. This evidence implies either distal movement of buccal teeth, or holding them against their normal forward growth. Whether it is by distal movement, or by maintaining the teeth in relatively stationary positions, we must keep in mind that the structures we are trying to influence are growing, moving in a forward and downward direction. While our appliance is exerting distal pressure on two chosen teeth, growth is bringing them and their neighbors forward. The fact remains that arch length is increased, room is provided for completely blocked-out teeth, or for self-correction of rotated teeth.

To illustrate some of the results which may be obtained with extraoral anchorage, a few treated cases will be shown.

HEADCAP AND APPLIANCE FOR INTERMITTENT PRESSURE

Fig. 1 shows the headcap and simple appliance for exerting light intermittent pressure. The headcap is made of rug binding, fit to each patient. We shrink the material before fitting the cap so that later washing will not alter the size. The appliance, made of 0.045 inch stainless steel wire, consists of a dental bow attached to a facial bow by wrapping brass wire around the two pieces in the midline and flowing solder over it. The arch is adjusted to enter the 0.045 inch round buccal tubes easily so that the patient can insert it without trouble. Molar stops are soldered to keep the dental arch advanced so that it does not touch the incisors. If lingual pressure on the incisors is desired, it can be secured by stretching a rubber dam or latex elastic from hooks soldered in the canine area. The facial bow is bent under at the ends for attachment of elastics between the appliance and the cap.

Fig. 1.—Headcap and appliance for exerting intermittent pressure.

EXTRAORAL ANCHORAGE FOR INCREASE OF ARCH LENGTH

Fig. 2 shows the models of a case in which increase of both upper and lower arch length is indicated, in addition to correction of the Class II relationship. The headplates show a rather wide freeway space, but no indication of a distally displaced mandible. The patient was 9 years, 6 months of age when treatment was started in February, 1950, with bands on the upper second deciduous molars. Light intermittent distal pressure was exerted on these teeth, using occipital anchorage. A palate was made to open the bite slightly and protect the tissue palatal to the upper left central incisor. In December, 1950, after eight months of treatment, a passive lower lingual arch was placed to take advantage of the difference between the widths of the second deciduous molars and second premolars. In February, 1951, after a year of treatment of the upper arch, an appliance was made to exert light distal pressure on the lower first molars, using the headcap. This was done because the x-rays showed space

between the lower first and second molars. The pressure was continued on the upper second deciduous molars until they were shed, then transferred to the first permanent molars in May, 1951.

Fig. 3 shows models of Aug. 27, 1951, after eighteen months of treatment on the upper arch, during fourteen and one-half months of which the bands were on deciduous teeth. During the last six of the eighteen months, pressure was exerted on the lower molars. The patient is now 11 years of age, has shed all the deciduous teeth and will soon be ready for treatment with fixed appliances. Although third molars are present, we hope to complete treatment without extractions, relying on extraoral anchorage to correct the mesiodistal relation without intermaxillary traction.

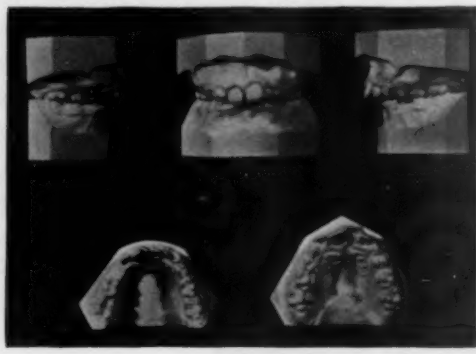

Fig. 2.

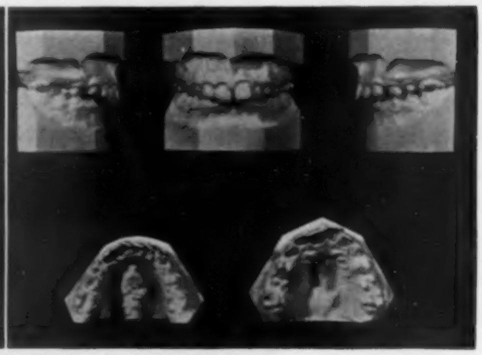

Fig. 3.

Fig. 2.—Models of Case 1 before treatment.
Fig. 3.—Models of Case 1 after eighteen months of treatment.

EXTRAORAL ANCHORAGE FOR DECREASE OF ARCH LENGTH

Case 2 is shown to illustrate the use of occipital anchorage to decrease arch length. Fig. 4 shows the models before treatment. The extremely poor skeletal pattern, the underdeveloped mandible, its lower border forming an angle of 45° with the Frankfort plane, make cautious treatment imperative. Before the patient came to my office, the upper first molars had been removed. The second molars were banded and intermittent pressure applied distally on these teeth from a headcap for the purpose of holding them back during the transition to complete permanent dentition. The upper first premolars were banded and intramaxillary latex elastics were attached from spurs on the lingual of the premolar bands to the buccal tubes of the molars only while the headgear was worn. Three months after the beginning of treatment, when the second premolars had erupted sufficiently to be banded, sectional arches were used to move the premolars back into contact with the molars. The headgear was discontinued at this time, although it might have been continued by using two tubes on the molar bands, one to receive the occipital appliance, the other for the sectional arch. When the premolars had been moved back, the cuspids were included in the sectional arches. Six months later, and nine months after the beginning of treatment, an upper arch with vertical loops between the cuspids and lateral incisors was tied in. Steel hooks were fashioned to go over the arch

just mesial to the loops and connect with the headcap. The patient cooperated cheerfully in wearing the headcap many hours during the day, as well as at night, as she was grateful for the improvement occurring in her mouth.

Fig. 5 shows models taken after fourteen months of treatment. No intermaxillary traction has been used in this case. Extraoral anchorage was the means of reducing arch length and the protrusion of the anterior teeth.

Fig. 4.

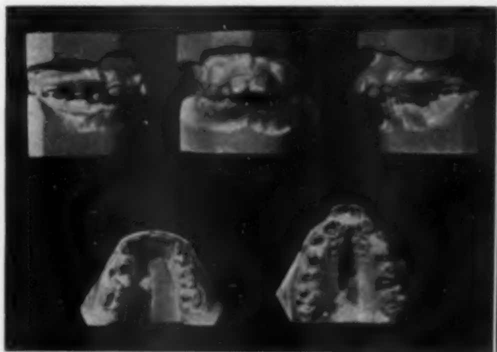

Fig. 5.

Fig. 6.

Fig. 4.—Models of Case 2 before treatment.
Fig. 5.—Models of Case 2 after fourteen months of treatment.
Fig. 6.—Photographs of patient in Case 2 before and after thirteen months of treatment.

The photographs show little if any improvement in her facial lines. She can close her lips a little more comfortably, and it is hoped that the faithful performance of lip exercises will bring improvement.

EXTRAORAL ANCHORAGE TO CHANGE MESIODISTAL RELATION OF UPPER TO LOWER TEETH

Change of mesiodistal relationship between upper and lower teeth from Class II to normal has been accomplished and reported by many orthodontists using extraoral anchorage without intermaxillary force. The beautiful results

shown by Bercu Fischer demonstrate what he can accomplish with extraoral anchorage and the edgewise appliance in distal en masse movement of upper teeth when he wishes to avoid disturbing the lower teeth by using them as anchorage.

Less precise results than those of Bercu Fischer have been reported by Albin Oppenheim. To achieve what he considered and found experimentally to be the closest approach to ideal biologic orthodontic movement, he used gentle intermittent force with an appliance that acted on two molars, the only teeth banded, depending upon the pull of the transseptal fibers to bring the premolars distally with the molars. When Oppenheim's results are characterized as less precise, no criticism is implied. The exact positioning of every tooth cannot always be achieved simply by an appliance which operates intermittently on but two teeth in the arch. The orthodontist must weigh the advantages and disadvantages of full banding against those of the simple two molar band technique in which no force whatever is active except when the headcap is worn. For the health and comfort of the mouth, there is little doubt that two bands are better than many. For less damage to investing tissues, intermittent force, if light, has been shown best. It is possible to exert gentle pressure with a fixed appliance, and it is likewise possible to exert strong pressure with a removable appliance. Intermittent force, however, is best delivered by an appliance which is worn only part time, and it is practically impossible to avoid constant pressure with a fixed appliance such as the edgewise. The tooth alignment obtained by Oppenheim's method is not as exact and perfect as that secured by an appliance which positions each tooth individually. It is, however, a vast improvement over the original malocclusion, and the teeth appear not to have been moved, but rather to have "grown that way" as indeed they have. Another factor to be weighed is the amount of time required for treatment. If only a few months or a year is available, a fixed appliance outweighs the removable appliance. If the patient and the orthodontist have time and perseverance, the removable appliance offers the advantages of simplicity, shorter and less frequent appointments for adjustment, and, what is sometimes very important to a sensitive child, no bands showing in the front of the mouth.

How the change from Class II to normal mesiodistal relationship is achieved with the use of extraoral anchorage, whether by distal movement of the maxillary teeth, by holding back their forward growth, or by a spontaneous forward positioning of the mandible following removal of occlusal interference, is a question which can be decided for each individual case by careful study of models and cephalometric x-rays made before, during, and following treatment. Cephalometric records have shown distal tipping of the upper molar crown with mesial movement of the root. They have shown the upper molar remaining in its same relative axial inclination and position while the mandibular molar has assumed a forward position. Surely any one or a combination of these changes is possible with extraoral anchorage. Certainly when the desired mesiodistal relation is attained without the use of the lower teeth as anchorage, we may be confident we have not disturbed the lower teeth in their relation to the body of the mandible or to the alveolar bone, either by tipping or bodily displacement.

Case 3 is one in which distal movement of the upper buccal segments is indicated, as well as some increase in lower arch length. The patient was brought to my office when she was 9 years of age. Headcap treatment on the upper teeth was recommended at this time, but was not undertaken because the parents feared the child would not cooperate. Fig. 7 shows the models taken two and one-half years later when the patient was eager for treatment and ready to cooperate by wearing the headcap. The malocclusion was diagnosed a Class I with mesial drift of the upper buccal segments.

The upper first molars were banded, and gentle intermittent pressure was applied from the headcap ten hours nightly, beginning Oct. 13, 1950. In April, 1951, six months later, the patient was given a palate thickened to open the bite not over 1 mm., hoping to permit some self-correction of the lower anterior rotations. Three months later, the buccal teeth were in contact and the bite plane was thickened. Models made in September, 1951 (Fig. 8), after ten months and three weeks of treatment, show the progress in upper arch lengthening, self-correction of rotations, and improved mesiodistal relations between upper and lower buccal teeth.

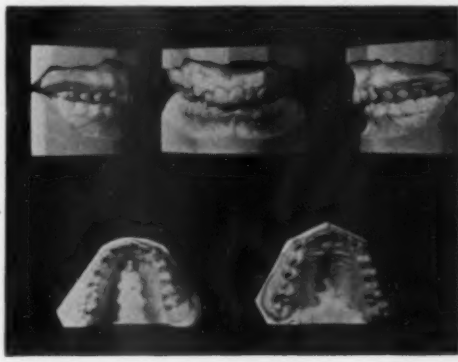

Fig. 7.

Fig. 8.

Fig. 7.—Models of Case 3 before treatment, aged 11 years, 6 months.
Fig. 8.—Models of Case 3 after 10 months, 3 weeks of treatment.

Case 4 is one which requires distal movement of the upper teeth as well as buccal movement of the upper right first molar. Light intermittent distal pressure was exerted on the upper first molars beginning Feb. 4, 1949. The 0.045 inch steel arch was made wider than the dental arch to correct the molar cross-bite. After the buccal teeth were in nearly normal relationship, bands were placed on the upper central incisors and gentle lingual pressure was exerted on these teeth by rubber dam elastics stretched between hooks soldered on the dental arch of the appliance. Bands with small mesially pointed lingual spurs were cemented to the upper canines. Rubber dam elastics were stretched from the molar tubes to the lingual spurs on the canine bands to guide the canines distally. To avoid mesial movement of the molars, these were worn only with the headgear. In March, 1950, thirteen and one-half months after treatment was started, the headgear was discontinued. Three months later an upper arch was tied in to depress the incisors and further close the spaces.

This arch was removed after three months and the patient returned to the simple appliance, using light distal force on the upper molars as retention, tapering off until she was wearing the appliance only once a week.

The models taken March 13, 1951, five and one-half months after the fixed arch was removed (Fig. 10) show the overbite has increased, and indicate that a Hawley retainer should have been used. Following a rest period, the patient has been given another four months of treatment with a fixed appliance, and we are now ready to retain the case. This time a palate with a bite plane will be used, and masseter temporal exercises to encourage vertical development, which the photographs (Fig. 11) indicate, are needed.

Fig. 9.

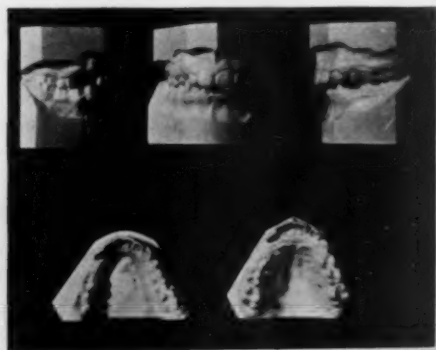

Fig. 10.

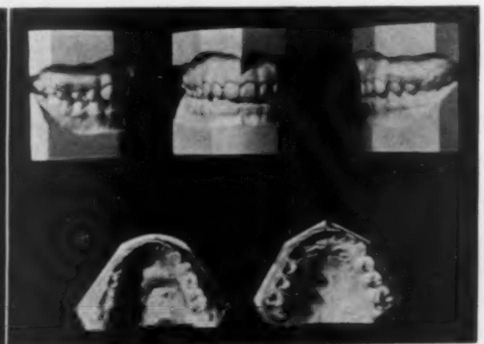

Fig. 11.

Fig. 9.—Models of Case 4 before treatment.
Fig. 10.—Models of Case 4 after treatment.
Fig. 11.—Photographs of patient in Case 4 before and after twenty-two months of treatment.

Case 5 shows a Class II malocclusion with a well-developed mandible. The patient was a thumb-sucker. Treatment was started when the patient was 8 years, 3 months of age, with the simple appliance attached to the upper second deciduous molars. After about four and one-half months of treatment, bands were placed on the upper deciduous canines with a 0.040 inch round wire soldered to connect the lingual surfaces and span the palate to break the thumb-

sucking which had persisted. Bands with lingual spurs were cemented to the upper central incisors to correct the tongue and lower lip habit. Two large rubber dam elastics were linked together and stretched from the brackets on the canines, exerting a lingual pressure on the incisors. Later, hooks were soldered to the dental arch for attachment of rubber dam elastics to bring lingual pressure on the protruding incisors.

In February, 1950, three years and eight months after placing the appliance, the patient, then almost 12 years of age, shed the deciduous molars which had been carrying the appliance. The bands had been removed from the incisors four months previously. There was no further treatment and no retention. The models shown in Fig. 13 were made eight months after the end of all treatment. Fig. 14 shows the photographs of the patient in this case.

Fig. 12.

Fig. 13.

Fig. 14.

Fig. 12.—Models of Case 5 before treatment.
Fig. 13.—Models of Case 5 eight months after appliance was removed.
Fig. 14.—Photographs of patient in Case 5 before and after treatment.

EXTRAORAL ANCHORAGE AS AN AUXILIARY TO INTRAORAL ANCHORAGE

When intermaxillary traction is the method chosen in treatment, occipital or cervical anchorage is a valuable auxiliary for reinforcing intraoral anchorage. Its advantage in preventing an undesirable protrusion of the mandible as a

result of wearing Class II elastics is quite obvious. Its value in holding the maxillary teeth back when Class III elastics are used to tip the lower teeth back for anchorage preparation in a Class II case was forcibly demonstrated in my office several years ago. A patient who had been instructed to wear the headcap to hold the upper teeth back discontinued wearing it when she became ill, but continued wearing Class III elastics. When she returned a month later, I fairly gasped when I saw her upper anterior teeth sticking out at me fully three-quarters of an inch in front of the lower teeth. My heart turns a somersault even now when I think of how she looked. With the return to the headcap on the upper arch and discontinuance of the Class III elastics, the mandible came forward again, the maxillary teeth went back, and the child lost her grotesque appearance. The case was completed satisfactorily without extraction of any teeth except third molars and has held nicely. She dropped in recently to let me see her teeth and tell me she was to be married, so the story ends happily.

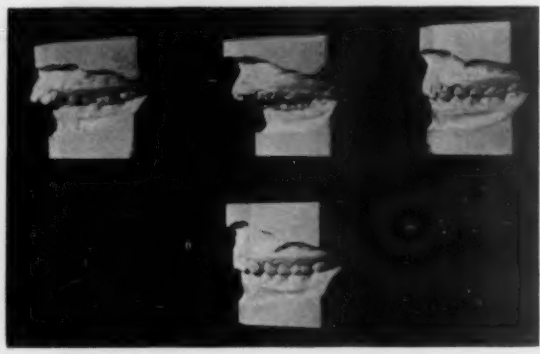

Fig. 15.

Fig. 16.

Fig. 15.—Case 6. Left side of the models, before, during, at end of treatment, and after two years of retention.

Fig. 16.—Photographs of patient in Case 6 before, during, and at end of treatment.

Fig. 15 shows the left side of the models at the beginning of treatment and after three and one-half months of treatment during which Class III elastics had been worn two months and eighteen days. The first month and a half a headcap had been worn on the upper appliance; the last month of wearing Class III elastics the headcap had not been worn. The third view on the upper level shows the teeth thirteen and one-half months after the second model. During this time, the patient had worn Class II elastics for ten and one-half months, and the lower anchorage had been reinforced by occipital anchorage. The lower models were taken two years after the completion of active treatment. The retention had been a lower lingual arch and an upper Hawley retainer with a bite plane. Fig. 16 shows the facial profiles of the patient before treatment, at the time of the catastrophe, and at the end of treatment.

EXTRAORAL ANCHORAGE AS RETENTION AFTER TOOTH MOVEMENT

Extraoral anchorage can be used to good advantage in retention when there has been distal movement of teeth. When intermittent force has been

used to secure a correction of the malocclusion, the intervals between wearing the headcap can be gradually increased in length until the appliance is worn only once a week. This method guards against relapse by occasional exercise of pressure against the teeth that have been moved. When a full upper appliance has been worn, and a Hawley retainer is chosen, if a relapse in the mesiodistal relation is feared, round tubes may be soldered to two molar bands and the simple application of light pressure against the molars at night with the headcap will help to stabilize the result.

THE ADVANTAGES OF EXTRAORAL ANCHORAGE IN THE APPLICATION OF LIGHT INTERMITTENT FORCES

Although it has been mentioned before, this paper on extraoral anchorage would be incomplete without further emphasis on the advantages to be gained from the application of light intermittent force. I know of no other way in which this gentle manner of moving teeth can be performed so well as by employing the headcap. Teeth can be moved without pain or soreness, without loosening, without any x-ray evidence of damage to the unseen tissues beneath the surface. When all these criteria are met, we can be fairly confident that the microscopic examination of pulp, cementum, periodontal membrane, and alveolar bone would show little evidence of damage or necrosis.

COOPERATION

Much has been said in this paper of the advantages, but little of the disadvantages of extraoral anchorage. There is one objection which is brought up in almost every discussion: the difficulty of securing patient cooperation. To this objection I would offer these comments. First the orthodontist himself must be convinced of the value of extraoral anchorage. He must be certain in his own mind that it is the best method for the case at hand. With no mental reservations, he must approach the parents and present the method and its advantages to them. He should not *ask* them if the patient will wear the headcap. He assumes that if they want the best for their child, it naturally follows that they will cooperate in seeing that he wears the appliance. If they do not agree, there is no use of starting treatment. If the parents do agree, convincing the child is the next step. We all know that there is an art in establishing the proper relationship between patient and orthodontist. Each of us has his own method of creating that friendly bond of mutual trust and interdependence. The patient comes to us for help, but we cannot help him without his cooperation which should be complete. If we cannot, by the third appointment, win the confidence of the patient and convince him, by our own sure manner and self-confidence, that we know what we are talking about and can do what we say we will, we had better relinquish the case to some other orthodontist who can capture the patient's confidence and secure his cooperation. But if we win the child over, he will do anything within reason that we ask, unless the moral support of the parents is lacking, and then we have failed in winning *their* confidence and cooperation.

SUMMARY

Extraoral anchorage is the only truly stationary anchorage. We cannot overemphasize the fact that no reliable unyielding anchorage can be established in the mouth.

1. Extraoral anchorage can be used as a means of increasing or decreasing arch length. This can be accomplished without forward reactionary movement of the buccal teeth.

2. As a means of changing mesiodistal relationships of upper to lower teeth, extraoral anchorage is a valuable aid, either in its simplest form, delivering distal pressure intermittently on two molars, or attached to a fixed appliance. This is advantageous when it is desirable to leave one dental arch completely undisturbed, and secure all the movement in the opposite arch.

3. Extraoral anchorage is indispensable as reinforcement of intraoral anchorage when minimal movement of the anchor teeth is desired.

4. As a form of retention, extraoral anchorage permits freely functional movement of teeth with intermittent restraint against tendencies to relapse.

5. Both laboratory experiments and clinical results have proved the advantages of light intermittent pressures in orthodontic treatment. Extraoral anchorage offers one of the most effective ways of applying gentle intermittent force to move teeth effectively with a minimum of pain to the patient and damage to the tissues.

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715 LAKE ST.

STATUS OF THE DENTAL SPECIALIST

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EARLY ORGANIZATION OF SPECIALTY BOARDS

PRIOR to 1930, the only specialty boards to be organized on a national level were in medicine, ophthalmology in 1917 and otolaryngology in 1924. The first board to be recognized in dentistry was the American Board of Orthodontists (now the American Board of Orthodontics) which was incorporated in the State of Illinois in January, 1930. It was ten years before a second board was organized, the American Board of Periodontology, in May, 1940. While there was no direct effort to organize specialty boards prior to 1940 (except in orthodontics), the parent organizations, which since have sponsored several boards, had been functioning on a national level for many years.[1]

OFFICIAL RECOGNITION

The Council on Dental Education first gave consideration to the status of the dental specialties in December, 1940, by appointing the Committee on Dental specialties. This committee, during the interim from 1940 to 1947, except for a two-year period during the war (1942 and 1943), made an exhaustive study of the problems related to certification.[2] Among the many problems and questions studied by the Council and Committee are the following:

1. What specialties in dentistry should have public recognition?
2. What training and experience should a dental graduate have and what requirements should he meet before being publicly recognized as a specialist?
3. Should the practice of a publicly recognized specialist be confined to his specialty?
4. How should the specialist be publicly recognized? (a) By a state license? (b) By certification by a specialty group?
5. What facilities, staffs, and courses for graduate, postgraduate, internship, residence, and other training were available in schools of dentistry and other institutions?
6. What states had laws governing the specialties in dentistry, and what variations in requirements were imposed by law in these states?
7. What had been the experiences of the specialties in medicine?

In 1946 the American Board of Oral Surgery, desiring to gain official recognition, stated,[2] ". . . Assuming that the function of approving specialty boards lies in the Council on Dental Education of the American Dental Association, the American Board of Oral Surgery requests the House of Delegates to authorize the Council by resolution to fix standards for the approval and recog-

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nition of the American Board of Oral Surgery." Accordingly, the House gave authority to the Council on Dental Education for the approval of the American Board of Oral Surgery and the remaining specialty boards (orthodontics, pedodontics, periodontology, and prosthodontics) during the Boston meeting of the American Dental Association, Aug. 6, 1947.[3] The following definition of a specialty in dentistry was adopted by the Council and was approved by the House of Delegates[4]: A specialty in dentistry is a field of practice which calls for intensive study and extended clinical and laboratory experience by a dentist beyond the training offered as a preparation for general practice in the undergraduate curriculum.

The action of the House of Delegates of the American Dental Association paralleled that of the American Medical Association in 1934, when the Council on Medical Education and Hospitals' "Essentials for Approved Specialty Boards" was given approval.[5, 6]

To date seven boards have been approved formally by the Council on Dental Education. One or more other nationally recognized dental societies now are considering the formation of a board.

The Council on Medical Education and Hospitals of the American Medical Association in their published report of September, 1949, stated that nineteen examining and certifying boards now have been approved. This report indicates that there is a total of 35,888 who have been certified in the various specialties of medicine.[7]

COUNCIL ON DENTAL EDUCATION

Requirements for Approval of a Specialty Board.—The Council on Dental Education has established the following minimum requirements, which the approved specialty board is obligated to recognize in the certification of any of its diplomates.[8] A specialty board, however, can increase the requirements above that specified by the Council, such as stipulated by the American Board of Oral Surgery.[9]

"*III. Qualifications of Candidates*

"1. Satisfactory moral and ethical standing in the dental profession.

"2. Citizenship in the United States.

"3. Graduation from a dental school accredited or otherwise recognized by the Council on Dental Education.

"4. A license to practice dentistry issued by a legally constituted examining board, or other legally constituted authority, in the United States.

"5. Membership in the American Dental Association or the National Dental Association.

"6. A period of study after graduation from a dental school of not less than two years in graduate or postgraduate courses, hospitals, clinics, dispensaries, preceptorships under the direction of certified specialists, or fundamental science laboratories recognized by the Council and by the specialty examining boards as competent to provide adequate training in the special field. This period of study may be pursued wholly in a school giving graduate or postgraduate courses and may or may not lead to an advanced degree; it may also be pursued wholly in hospitals, clinics, dispensaries, preceptorships, or fundamental science laboratories; or it may be pursued partially in schools or preceptorships and partially in other types of institutions.

"One full academic year of graduate or postgraduate study will be considered as equivalent to a calendar year. Teaching or a fellowship in the field of the specialty may be considered in partial fulfillment of this requirement. The character of this period of study will be determined by the specialty examining board subject to approval by the Council.

"7. An additional period of not less than three years of practice devoted primarily and principally to the specialty, which may be combined with further study under conditions determined by the board, subject to approval by the Council.

"8. A satisfactory standing in the examination prescribed by the specialty examining board.

"*IV. Waivers*

"Specialty certificates issued upon an equivalent basis prior to the adoption of these requirements by boards already in operation will be honored by the Council upon the approval of such boards; and other boards, which secure approval before issuing certificates, may grant certificates under waiver to specialists with recognized standing and ten years of experience upon requirements mutually satisfactory to the Council and the boards."

THE ADVISORY BOARD FOR DENTAL SPECIALTIES

Organization.—A preliminary meeting of the various organizations in the dental specialties was held in St. Louis in October, 1938. The Advisory Board for Dental Specialties, however, was organized formally in Milwaukee, July 18, 1939. Subsequent meetings were held in Cleveland in September, 1940, and Houston, October, 1941. The activities of the Advisory Board were interrupted during the war, and it was not reactivated until the Boston meeting of the American Dental Association in August, 1947.[1, 2]

Purpose.—The purpose of the Advisory Board for Dental Specialties parallels that of the Advisory Board for Medical Specialties organized in 1933-1934. In addition to the specialty boards which constitute its membership, the Advisory Board for Medical Specialties has elected for representation the Association of American Medical Colleges, the American Hospital Association, the Federation of State Medical Boards of the United States, and the National Board of Medical Examiners.[2]

The Advisory Board for Dental Specialties, now composed of two official representatives from each of the seven recognized specialty boards, the American Association of Dental Schools, the American Association of Dental Examiners, and the National Board of Dental Examiners, was organized to aid in coordinating the policies and activities of the various specialty boards, by study and by conferences with all concerned, so that there may be common standards, principles, and objectives for certification mutually agreed on by all boards. The Advisory Board is organized to act as a clearinghouse to which problems of certification may be directed. Then, too, it can act as a liaison among the several specialty boards, the Council on Dental Education, the American Association of Dental Schools, and the miscellaneous institutions (hospitals, clinics, and so forth) that endeavor to prepare candidates for certification.

ARE SPECIALTIES IN DENTISTRY WARRANTED?

Considerable concern has been expressed by some members of the profession as to the possible detrimental influence the specialties may have on the practice

of dentistry. Wright recently wrote, "If specialization in dentistry follows the pattern established in medicine, the time will come when the professional rights of dentists will be challenged, as are those of physicians at this very moment. If so-called dental specialists are to be recognized by state law, as now prevails in six states the legal rights of dentists in the future will perhaps be limited by undesirable changes in dental practice acts." He summarized in part his opinions by stating, "Dentistry is the equivalent of an oral specialty in the practice of medicine and dentists are specialists equivalent to specialists in medicine," and "The majority of dentists are qualified by aptitude and inclination to practice the entire field of dentistry."[10]

Robinson, long a member of the Council on Dental Education, and one who has studied as well as considered all areas of the problem related to the development of the specialties, believes the specialties in dentistry are warranted and essential. He stated, "The basic dental curriculum represents an irreducible minimum of instruction necessary to equip the dental graduate to begin the practice of his profession. It provides sound general instruction in both the science of dentistry and the art of dental practice; but it does not insure an exhaustive knowledge of the basic sciences which is necessary for the education of the specialist, nor can it equip the student to treat, with the competence of an expert, all the difficult conditions which he may encounter in his practice of the dental art. The purpose of the undergraduate course of study is not to produce experts but to advance the student to a level of competence that will enable him to cope successfully with routine requirements of oral health care, and to ground him in sound scholarship that will make it possible for him to continue his professional growth through the opportunities for educational advancement which are made available to him by the profession."[11]

Robinson clearly expressed my opinion regarding the relationship between the general practitioner and the specialist. There is no doubt a small percentage of general practitioners who possess knowledge and skills above the average in several fields of dentistry, yet few would profess to be an expert in all areas. The time now devoted to the entire dental curriculum (maximum hours designated by the Council on Dental Education) does not permit an adequate experience in any area of dentistry for the training of an expert.

The general practitioner is and always will be the foundation of our profession, and it is he who will govern the standards of dentistry. It must be recognized, too, that dental education's first responsibility is to the undergraduate student, who should be encouraged to prepare himself for the general practice of dentistry. It is agreed that the average general practitioner is prepared to accept the responsibility of giving adequate dental care to a large segment of the population. However, there is justification and need for individuals who desire to limit their practice to one field, and who likewise will prepare themselves adequately to assume the role of a specialist.

Responsibilities of the Specialty Groups and the General Practitioners.—It is imperative that those concerned with the specialties, namely, the respective boards as well as the diplomates, be cognizant of the dangers of overspecialization and of their continued responsibilities to the profession and to the public.

Those practitioners, who desire to limit their practice, cannot afford to limit their responsibilities to their own small organizations and thereby divorce themselves from the parent body who has sponsored and clothed them. Furthermore, the general practitioner cannot afford to be absent from dental society meetings, and to evade refresher and postgraduate education, if he expects to retain professional leadership. It would be interesting indeed to evaluate the dental audiences, committees, and officers of societies in various areas of the country to determine the percentage of general practitioners and specialists who assume responsibilities and leadership. One probably would find a large percentage of leadership directed to the specialist.

How many and what privileges should be directed to the specialist in dentistry or medicine with relation to increased monetary considerations, and choice assignments in the various Federal Services is debatable. For example, the diplomates in the Veterans Administration receive an increased base pay allowance, as compared with the general practitioner. Since only a few, less than one-fourth, can realize such distinction, it leads to lowered morale. It is evident that only a small percentage can receive postgraduate or graduate training to qualify for certification, once they are in the Federal Services. It seems logical that equal opportunities should be made available to all who can qualify academically and professionally, regardless of the individual's assignment. It is important, too, that any planning for the specialist in dentistry on the part of the general practitioner or on the part of the specialist be done with the full realization of what influences it will have on dental-medical relationships, not only in private life but also in the various Federal Services.

Advantages of Specialization to the Profession.—While there are dangers and serious problems surrounding specialization in dentistry, which must be approached rationally and openly, there also are significant advantages which have accrued and which will continue to accrue for the profession. Specialization, in accordance with the Council on Dental Education's criteria for certification, leads to exhaustive study and to research, which will continue to raise the standards of dentistry and to make available to the people a more adequate dental service. The conduct of a graduate program in a school of dentistry, with its requirement for research, lends a strong stimulating influence for greater achievement to the entire undergraduate program, including the staff as well as the students. It is, further, an area where some excellent dental teachers are developed.

OVERSPECIALIZATION

The comments made by me[12] in January, 1949, regarding the status of the specialties are acceptable at this time: "There is no immediate concern about overspecialization, yet this probability does exist in dentistry. The general practitioner, in some instances during the past few years of economic advantage, has elected to limit his practice (only in those states without a specialty law) even though he has had no formal training or adequate experience to warrant the designation of a specialist.

"How many of these dentists who have limited their practices, without benefit of adequate training and experience, can survive an economic recession will be determined in a large measure by their past performance. The percentage who will return to general practice in time of economic stress will be large. When the demand for dental service in the office of the general practitioner becomes less, then fewer patients will be directed to the dentist who limits his practice. How soon this critical point is reached in the average general practitioner's office cannot be predicted. The number of dentists required for the federal and armed services over a period of years certainly will influence the flow of private patients to every office including that of the specialist.

"There is a demand and a need for the specialist in the many fields of dentistry. Among the foremost specialists of today in orthodontics, oral surgery, pedodontics, periodontia and prosthodontia, there are men who have had no formal graduate or postgraduate training. Such men have come up the 'hard way,' they have learned by experience, preceptorship, self-disciplined study, study clubs, short courses and constant attendance at dental meetings. The profession and the public may justly point to such self-made men with pride. While this system of apprenticeship or trial-and-error has produced many outstanding dentists who now limit their practice, there are also those with less skill and those who have not been students of dentistry, who have greatly harmed the public and the profession.

"It seems logical, therefore, that an extended period of training for the would-be specialist is most desirable. In a well organized course the student receives close personal supervision, and he is apprised of the mistakes of others. Accordingly, the trial-and-error period is reduced to the minimum.

"It must be recognized, too, that graduate and postgraduate training during the past years was offered only in a few schools throughout the country. Even now the majority of the dental schools do not afford graduate or postgraduate training for all of the specialties. Therefore, one is not justified in being too critical of the present day specialist and the manner in which he has been obligated to get experience and training.

"There is no reason why the profession and the public should continue to accept all who profess to be a specialist in dentistry. The profession, if it is to maintain the confidence of the people, must support an effective screening process such as is afforded now by the specialty boards approved by the Council on Dental Education, and such legislation on a state level which is in harmony with the standards provided by the specialty boards."

CERTIFICATION ON STATE AND NATIONAL LEVEL

State Certification.—Six states now have laws governing the licensing of specialists in dentistry, and each of these states presents some variation in the basic demands of the applicants.

Many statements have been made for and against the enactment of laws on a state level to control specialization in dentistry. Some groups maintain that all states now have laws which govern the licensing of dentists for the

practice of dentistry, that such laws are accepted by the profession, that these statutes serve a useful purpose to society and to the profession, and that states' rights have been maintained. These pertinent, logical questions then may be asked: Why cannot state legislation be effected to protect the public and the profession further in response to the ever-increasing problems of specializations, and are the present laws broad enough in scope in the average state to protect effectively the public and the profession? Further, is charlatanism being sponsored and in reality being condoned by the dental profession within states that have no effective legal instrument for the control of specialism? The profession has grown in numbers and in stature; with this expansion and elevation in the eyes of society, responsibilities have been added. While the specialties have developed to a high degree and to the extent that official recognition has been afforded this problem in the House of Delegates of the American Dental Association, legislation on a state level to control such practice is virtually nonexistent. Is there any means for the protection of the public other than by legal restrictions? Certification on a national level assures the public and the profession that a man is qualified to practice his specialty, but it does not prevent the unqualified dentist from making an announcement that he, too, is a specialist. How is the profession and the public to know who is qualified, and how much damage is done by individuals who profess without adequate training that they are specialists?

There is adequate reason to believe that effective legal restrictions can be processed in every state, which will be in harmony with a general basic pattern and will enhance considerably the respect for dentistry. Medicine, to date, has elected to rely on national certification, and in the main this policy which does not favor state licensure of specialists has been effective. Medicine, a profession which is dentistry's senior by many years, has evolved a system of internship and residencies in hospitals not paralleled by dentistry. Furthermore, the hospitals that are recognized and approved throughout the nation require that physicians be certified before gaining staff privileges. Such qualifications and standards on the part of the hospitals and the medical profession have been most effective in preventing unqualified physicians from announcing to the public that they were specialists. Dentistry, except to a limited degree in the field of oral surgery, has no such effective instrument of control at this stage of professional development.

National Certification.—There are a number of reasons why certification on a national level is desirable and essential, even though universal certification existed on the state level. It seems reasonable to believe that a state board responsible for certification on a state level would recognize without examination any candidate who desires to specialize in that state, is certified by one of the American boards, and has a license to practice in that state. This would mean that a dentist who has a license in Oklahoma, in Illinois, and in Michigan, and who has a certificate from the American Board of Orthodontics, could legally practice his specialty in any of the three states.

There are, too, states with a relatively small professional population that would not have a board qualified to give an examination in one or more of the

specialties, yet desire to have effective state legislation to permit recognition of dentists certified by an American Board.

Another reason why national certification is essential is the demand for specialists in the Federal Services. For example, if the specialty boards had been functioning prior to the last war, the Army and Navy could have had a more accurate basis for the classification of dentists coming into the service. There were hundreds of self-professed oral surgeons who indicated that they had been on certain hospital staffs, and that their practices had been devoted largely to oral surgery, but there was no effective efficient way of checking on the individual's ability. If an officer could have presented credentials to indicate that he was certified by the American Board of Oral Surgery, an important post could have been confidently filled with little delay. The same applied to many who professed to be prosthodontists during the war.

Limitation of Practice.—The Committee on Dental Specialties of the Council on Dental Education commented on this important point:

> The Committee takes the view that the chief concern of both the public and the profession is in the education, training and distinctive qualifications of the specialist. Is he professionally qualified by training, experience and accomplishments to announce himself before the public as a specialist? The amount of time he may choose to give to general practice and to special practice is not a matter of public significance. He should be free or at least his specialty board should be free to determine the question of limitation of practice.

Under the regulations of the states and specialty boards which require limitation of practice, an individual may have graduate and have other special training, as well as a vast clinical experience in a specialty far in advance of many diplomates, yet be unable to qualify for certification. I concur with the statement of the Council, ". . . the chief concern of both the public and the profession is in the education, training and distinctive qualifications of the specialist."[2]

State boards of dental examiners in those states which have specialty laws and the certification boards on a national level have one prime objective—to evaluate a dentist's ability, experience, and ethical standards. State laws involving the specialties have one other important function—to prevent unqualified or unethical practitioners of dentistry from announcing to the public their limitation of practice or their special qualifications. Limitation of practice in itself certainly is no criterion of ability, experience, and one's standards in the conduct of practice. Three of the states (Illinois, Kansas, and South Carolina) which have specialty laws, and a fourth state (Tennessee) with provisions, require that the specialist who is certified must limit his practice.[2] The American Boards of Orthodontics and of Oral Surgery also specify that their diplomates must limit their practice.[2]

SUMMARY

1. The Council on Dental Education has been given authority by the House of Delegates of the American Dental Association to approve the seven recognized specialty boards.

2. The Council on Dental Education has established minimum requirements, which the approved specialty board is obligated to recognize in the certification of any of its diplomates.

3. Some members of the profession question the need for the specialist, and, further, express danger in overspecialization. In defense of the specialties, it is stated that few practitioners would profess to be an expert in all areas of dentistry. Further, the time now devoted to the entire undergraduate dental curriculum does not permit an adequate experience in any area of dentistry for the training of an expert.

4. It is agreed that the average general practitioner is prepared to give adequate care to a large segment of population.

5. In addition to the items cited, the following are discussed: (a) the several responsibilities of the specialty groups and the general practitioners; (b) advantages and the problems surrounding specialization; (c) overspecialization; (d) certification on state and national level.

CONCLUSIONS

1. There is a need for the specialties in dentistry.

2. Certification on a national level, as well as on a state level, under given conditions, is desirable.

3. Limitation of practice is not an acceptable criterion for determining individual's qualifications for certification as a specialist.

4. There is no immediate concern about overspecialization in dentistry.

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BILATERAL CLASS II, DIVISION 1 MALOCCLUSION TREATED WITH AN OCCLUSAL GUIDE PLANE

Report of a Case

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THE patient was J. V., a white boy, aged 10 years, 8 months when first seen in September, 1946.

Diagnosis: The arch form of the maxillary arch was narrow and pointed. The mandible was retrusive and undeveloped. The 6-year molars had drifted mesially due to premature loss of the second deciduous molars. The roentgenograms revealed congenital absence of the mandibular central incisors.

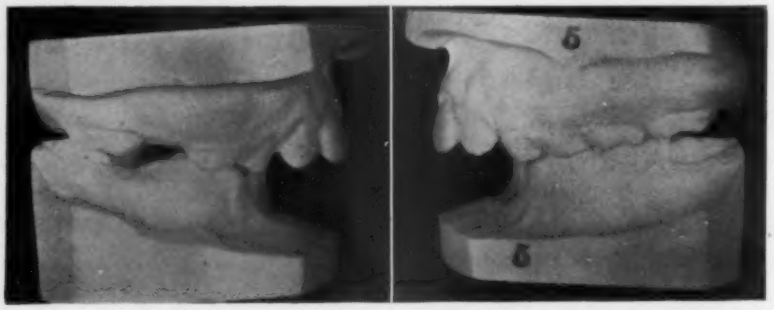

Fig. 1.—J. V., aged 10 years, 8 months, September, 1946.

Fig. 2.—J. V., aged 14 years, 10 months, November, 1950.

History.—The patient was small and undeveloped for his age. There was a history of frequent sinus attacks but none of serious illness. He had had usual childhood diseases. He had very few fillings, with numerous cavities and broken deciduous teeth.

Etiology.—Mandibular and general bony growth were arrested. There was a history of thumb-sucking but not to any appreciable extent. There was a Class II tendency on his maternal side.

Plan of Treatment.—

1. Encourage mandibular development and shift entire mandible mesially.
2. Move all upper teeth distally.
3. Open the bite.

Fig. 3.—J. V., aged 14 years, 10 months, November, 1950.

Mechanics of Treatment.—Molar bands were constructed and cemented on mandibular and maxillary 6-year molars. Chrome metal maxillary labial and mandibular labial and lingual appliances, 0.036 inch, were utilized, and Class II elastics were instituted. In January, 1947, bands were cemented on maxillary

Fig. 4.—Retainer used.

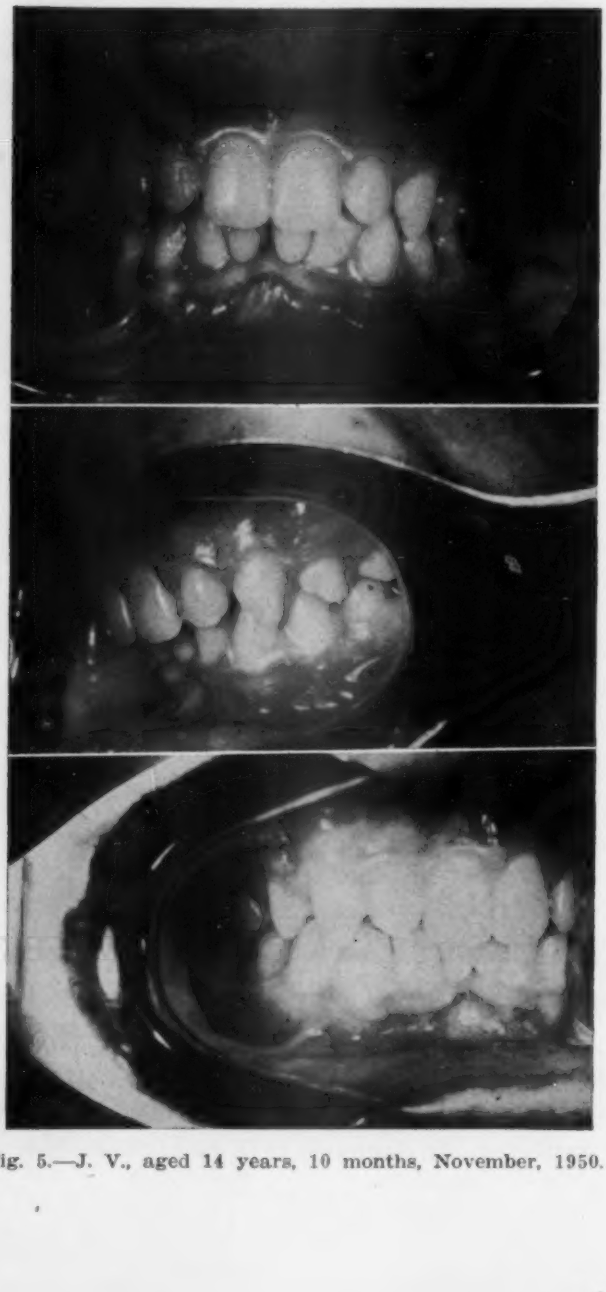

Fig. 5.—J. V., aged 14 years, 10 months, November, 1950.

anterior teeth and a twin arch was inserted. Progress was very slow due to frequent breakage and lack of conscientious wearing of elastics. In February, 1948, all appliances and bands were discarded and reconstructed utilizing an occlusal guide plane as advocated by Dr. Oren Oliver. In April, 1949, appliances were removed and an acrylic retainer replacing the mandibular central incisors was inserted.

Progress of Case.—The patient was seen at three-week intervals during treatment period: cooperation, spasmodic; frequent breakage.

Secondary Treatment.—In January, 1950, oral examination revealed that although the correct intercuspal relationship had maintained itself on the left side it appeared to be slipping on the right. A new occlusal guide plane was constructed and appliance therapy instituted. Progress was uneventful. All appliances were removed in August, 1950, and the patient wore a Kesling positioner for a month and a half. In November, 1950, a Dentocoll impression was taken and a Nobilium casting made replacing the mandibular central incisors and extending from 6-year molar to 6-year molar.

Fig. 6.—J. V., aged 14 years, 10 months, November, 1950.

Results Achieved.—The bite was opened—mandibular development was remarkable in this particular case. Movement of maxillary teeth distally is questionable and I personally do not feel that this occurred.

Observations and Conclusions.—The remarkable response to appliance therapy in this instance is due only partially to orthodontic interference. This patient during treatment grew in every respect, physically and mentally. It would be easy for one to talk himself into believing that his orthodontic effort and treatment produced the pleasing result attained. If one did this he would only be dodging facts that are only too obvious when faced. Mandibular width from 6-year molars to 6-year molars remained essentially the same. At the beginning of treatment there existed approximately 12 mm. distance from the incisal edge of the maxillary central incisors to the incisal edge of the mandibular lateral incisors. The mesial movement of the mandible and the increase in

vertical height were entirely due to temporomandibular change which is the only area remaining in the mandible at that age that could be changed. This case would have made a most interesting one for cephalometric tracings.

Postreatment Findings.—This patient was seen the week previous to writing and was still in an excellent occlusal relationship. It is my feeling that this case will maintain itself due to the very favorable growth experienced during and since treatment.

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FOUR CONGENITALLY MISSING CANINES

A Case Report

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THE patient, T. L. D., was a white girl, aged 10 years, 3 months.

Diagnosis: Class II, Division 1 malocclusion; dental malfunction due to protraction of maxillary arch complicated by the congenital absence of four permanent canines.

History and General Clinical Picture.—The patient was an alert, vivacious girl, with excellent posture and general physical condition. Childhood diseases included measles, mumps, and chicken pox. Tonsils and adenoids were removed at 5 years of age. There was no further history of surgery. Gingival tissue tone was good, hygiene excellent, tongue and oral mucosa normal, swallowing normal, respiration and speech normal, family background excellent with no history of familial pathology. Mother's obstetrical history was normal. The child's pediatric history was uneventful except for a severe attack of measles at 5½ years of age with temperature remaining over 102° F. for four days. Enamel hypoplasia was marked on four upper incisors. She had pegged deciduous canines.

Etiology.—Incorrect locking of the first permanent molars caused maxillary protraction plus a mild mandibular retraction.

Plan of Treatment.—

A. *General Plan:* Correct all localized dental anomalies and the curve of Spee. Open spaces for permanent canine restorations. Carry the maxillary arch distally into correct relationship with the mandibular arch and with the cranium. Deciduous canines to be retained as long as possible.

B. *Appliances used:* An edgewise appliance was placed during July of 1947. Appliance was removed in February of 1949. Treatment time was nineteen months. No appliances were used on the deciduous canines at any time.

C. *Supplemental therapy:* None.

Progress of Case.—The patient was seen at two-week intervals during the primary treatment. Cooperation was excellent. Maxillary deciduous canines were exfoliated during primary treatment. Some loosening of lower deciduous canines was observed.

Secondary Treatment.—An upper Hawley retainer incorporating two maxillary canines was used in the maxillary arch. Lower retention consisted of a removable Hawley lingual retainer from lower first molar to lower first molar. The patient was seen monthly for one year and then alternate months for a second year.

Results Achieved.—Esthetic results were gratifying. Functional occlusion was not too satisfactory. Treatment objectives had been partially fulfilled.

Observations and Conclusions.—During this patient's original examination it was determined that four permanent canines were congenitally absent. The literature was searched for the past thirty years to determine precedent in the treatment. No reports were found. At a later date two illustrations of a case of this type were found in Salzmann's *Principles of Orthodontics,* Figs. 161 and 162.

Two alternative treatment plans were considered:

A. Open canine spaces and establish a normal relationship of all other dental units to one another and to the cranium.

B. Close all spaces.

A number of factors had to be considered with each alternative plan, as noted here.

A. If spaces were to be opened, the most important consideration was the difficulty of restoring the permanent canines later in life. This probably is the most important factor militating against the opening of the normal canine space.

B. The alternative of closing all spaces presented other problems.

1. The limitations of lingual movement of the anterior teeth.

2. The difficulty of obtaining the required amount of mesial movement of upper and lower buccal segments necessary to complete space closure.

3. The size of the tongue militating against a successful permanent result under this particular procedure.

4. The questionable possibility of correctly positioning roots of the first premolar teeth.

5. The final facial appearance of the patient.

The most important consideration in this particular problem was that the child have a good face when the correction was completed—something that would be of a permanent nature. Photographs and digital examination showed that this child had a rather well-developed chin point. No cephalometric x-rays were available at the time treatment was started.

I suggested at this time that consultations be held with two other men in the community to receive their opinions as to how treatment should be managed. Subsequently the patient was referred to Dr. Stenson Dillon and Dr. H. V. Muchnic for study. Both men were of the opinion that permanent canine spaces should be held open. On the basis of the difficulty of reconstructions later, I was against this particular plan of treatment. Further study of the problem with space closures in mind brought out the difficulty with which proper facial features could be shown upon completion of the work. Treatment was instituted with the plan of opening spaces. It was felt that if the result was not satisfactory at the conclusion of primary treatment, the child's age would permit retreatment and space closure.

Posttreatment Findings.—Two years after the conclusion of primary treatment, function and position of the teeth were fair. Facial appearance was most pleasing. There was no evidence of relapse. Dental roentgenographic studies showed all teeth and roots in good position. There was no evidence of caries. A slight degree of root resorption was observed on the four upper anterior teeth. Alveolar crest changes of a very minor degree were seen in the lower

Fig. 1.

Fig. 2.

Fig. 1.—Before treatment.
Fig. 2.—After treatment.

buccal segments. Cephalometric roentgenographic studies made two years after the conclusion of primary treatment showed the following values as compared to the Downs analysis:

	T.L.D.	DOWNS MEAN AVERAGE
Facial angle	91.5	87.7
Angle of convexity	–3	0
AB plane to facial plane	–4.5	–4.8
Mandibular plane	18	21.9
Y axis	59	59.4
Cant of occlusal plane	8	+9.3
Angle $\underline{/1}$ to $\overline{1/}$	133	135.4
Angle $\overline{/1}$ to occlusal plane	+18	14.5
Angle $\overline{/1}$ to mandibular plane	+8	+1.4
$\underline{/1}$ to AP plane (mm.)	+1	2.7

Studies of all records made two years following the conclusion of primary treatment confirm the feeling that the procedures outlined herein and the treatment recommendations made by the two consultants were correct.

While there is still a problem ahead as to the permanent restoration of the maxillary canines, it is believed at this time that a removable denture will be

the most feasible solution to this particular problem. At the time of writing, the child was wearing a retaining device with the two maxillary canines placed on the Hawley retainer. She was quite comfortable and esthetically was very pleasing in appearance. The lower deciduous canines had not yet been exfoliated.

This case is presented for consideration because of its unusual problems in treatment planning and management. While congenitally missing teeth are everyday problems in orthodontics, the absence of four permanent canines is a rarity.

I feel that if a cephalometric appraisal of the child's facial growth pattern had been available at the time orthodontic treatment was originally planned, a great deal of uncertainty as to procedure could have been quickly eliminated.

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TISSUE REACTIONS OF BONE UPON MECHANICAL STRESSES

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In a previous paper[3, 4] I accounted for the biochemical tissue reactions accompanying bone formation and bone resorption. Principally the nature of these processes may be summarized as follows: A soluble, preformed bone substance is circulating in the blood in the form of certain calcium-phosphate-citrate-protein fractions of the plasma. These soluble and partly ionized blood fractions at any time may be hydrolyzed, precipitated, and adsorptively linked to a protein matrix by means of specific cell enzymes in the so-called osteoblasts, and the developed, "gelated," rigid bone substance results. This bone substance consists of a more simple chemical compound than do the soluble, preformed plasma fractions, and so a certain portion of energy is liberated in the osteogenesis.

The bone matrix to which the bone salts are adsorbed is formed by a sort of "inducing" chemical effect upon the mesenchymal, young, pluripotent connective tissues by means of a probably hormonal substance, osteogen.

The native scleroproteins, glucoproteins, and nucleoproteins of the connective tissues are denatured and form the osseocollagen, the osseomucoid, and the osseoalbuminoid of the bone matrix, substances which display an increased power of combining with calcium.

The former conception of the osteogenesis which presupposed specific, pre-existing osteoblasts and which always emphasized that "bone-cells only may be formed by other bone-cells" does not seem to be maintained any longer, because it is unable to explain neither the bone formation close to necrotic bone cells nor the heterotopic bone formation far away from pre-existing osteoblasts.[9] The differentiation of the osteoblasts from the connective tissue cells can be produced experimentally by injection of extracts from epiphyseal cartilage, bone autolysates, or developed bone tissue. This bone-forming substance seems to be produced in direct dependence on sound, normal-functioning osteocytes. Traumatic fractures are able to deliberate this substance and to activate the bone formation (callus formation). The osteogen is not specific, it supports heating, and is soluble in usual fat-dissolving fluids.[1]

Ascorbic acid (vitamin C) also plays an important role in the differentiation of the osteoblasts and in the bone matrix formation. The process, "dissolved $\leftrightarrow$ gelated bone substance" is reversible, because the cell enzymes which act as catalyzing medium between the two different phases may cause a transformation to both sides of the process. By the transformation to the dissolved phase (bone resorption) a certain supply of energy by accompanying oxidizing processes is required, because it is the matter of forming complex soluble chemical compounds from simpler insoluble chemical compounds. The bone tissues seem to

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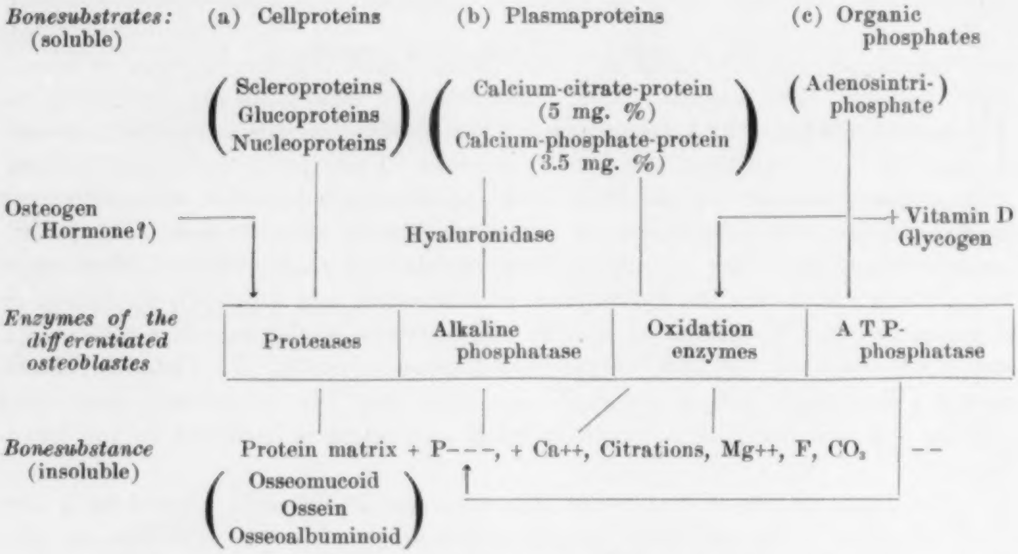
be in a state of dynamic equilibrium with the bone-forming fractions of the blood, a fact which has been stated by means of experiments with radioactive isotopes (Fig. 1).



Calcium-phosphate-citrate-protein (developed bone) + calcium carbonate.

Fig. 1.—A schematic representation of the factors participating in the osteogenesis.

According to the actual circumstances this equilibrium may call forth either the (a) bone apposition or (b) the bone resportion. Probably these two processes are only apparently antagonistic, because the same substances are entering in both of them and because the same enzymes are catalyzing them only now in hydrolyzing form and now in synthesizing form. Organic and inorganic compounds are mixed together in a manner which makes it very difficult to distinguish the single phases exactly from another. Even in advanced age we find a displacement of the bone trabeculae by bone formation and bone resorption. Metaphorically we have to imagine the bone molecules like a rank of soldiers from which, f. i., one hundred men are removed from the right wing at the same time as another one hundred men are added to the left wing. The rank remains the same, but it is displaced from one side to another.

In connection with the normal bone tissue reactions a certain question has always been of great interest to the surgeon and the orthodontist, namely, in which manner the mechanical stresses exert a growth-promoting or a growth-inhibiting effect upon the bones. We still want a satisfying explanation of the way in which the mechanical forces stimulate now the apposition process and now the resorption process, in short how the function acts upon these tissues.

It is very strange that although bone shows an astonishing rigidity and strength it has a peculiar pliability and plasticity in the living state.

From experiments performed in order to elucidate this phenomenon, some so-called regularities have been drawn, but these laws very often appear to be quite contradicting and misleading, as, for instance, the so-called Flourens'

pressure theory which briefly tells that bone reacts to pressure with loss of substance and to tension with apposition of substance. This conception, however, seems to be too broad. The bones are not only grossly adapted to functional stresses, but also the finer-detailed structure is dependent upon the forces applied. The presence of Sharpey's fibers in regions directly submitted to tension, the various special arrangements of Haversian systems, and, finally, the varying directions of fibrils in the bone matrix are examples of this fact.

The adaption of the bones to pressure or tension has found its distinct anatomical expression in the formation of different tissues on the surface of bones. Where bones are exposed to constant pressure they are covered by avascular hyaline cartilage or fibrous connective tissue. The neutral, not exposed surfaces, or those which are under tension, are covered by vascular tissue (periosteum).

It appears that the bone tissues posses a certain autonomy and that they follow an independent growth pattern without any regard to *local* and mechanical stimuli. In most body tissues the heredity constitution seems to play a greater role than do outer influence and this is also the case with bone.

Grüneberg[8] made some experiments with a certain Grey-Lethal mutation of the mouse, which is distinguished by the failure of second resorptions of bone. He was able to demonstrate that bone reacts to pressure only if the heredity basis for doing so is undisturbed. The relation between pressure stimulus and response is therefore not *direct* as assumed hitherto, but subject to conditions based on the heredity constitution. If the heredity mechanism of resorption is disturbed, as just observed in the previously mentioned Grey-Lethal mice, the local stimuli are not sufficient to induce the resorption, i.e., to differentiate the osteoclasts and to start the osteolysis. This fact has recently been confirmed by Bhaskar, Schour, Greep, and Weinmann.[2]

The tissue reactions of bone may be compared with a clock in which every wheel fits to another in a certain rhythm. This rhythm cannot be altered locally, because it is regulated by the supreme rhythm of the body, i.e., by heredity basis and the hormonal factors. Only in harmony with the normal physiologic functions are we able to stimulate or inhibit the normal growth of bone.

In other words, neither the teeth nor their movements form the alveolar bone and the jaw, but the jawbone alone determines the form and position of the teeth, because bone is a more primitive, vital, and biologically active tissue than are the teeth. Very interesting in this connection are the experiments performed by some followers of the so-called function-jaw-orthopedics with the purpose of invalidating Flourens' pressure theory.

Eschler and Häupl[7] applied some different orthodontic apparatus on dogs' teeth after they had excluded every muscular and functional effect by cutting the third trigeminal nerve, hypoglossi, and facialis. Forty-eight hours later the animals were killed and histologically examined. It appeared that not the least changes in bone around the teeth could be observed, although the teeth had been exposed to both pressure and tension by the orthodontic apparatus and although previous experiments had shown great changes of the bone and periapical tissue of normal "functioning" dogs already after twenty-seven hours. These experi-

ments seem to prove that a tension alone is not able to start the osteoblastic activity and the bone formation. The lack of function prevents the rebuilding of the bone. Furthermore, it is confirmed that no resorption can start without accompanying bone apposition. In normal physiological conditions these two processes always will go together. In order to secure their results against every criticism the previously mentioned authors performed another experiment: After cutting the same nerves as before and after having applied the same orthodontic apparatus on the teeth, they tried to imitate the normal muscular effect artificially in the "dead" areas, and this time they succeeded in demonstrating all the expected bone formations and bone resorptions, which had to follow the application of the orthodontic apparatus.

However it has recently been demonstrated experimentally by Reitan[12] that the previously mentioned cell proliferations ascribed by Eschler and Häupl to the muscle function also may be called forth in paralyzed jaws and that the effect of the orthodontic apparatus (the activator) may be explained by a slight traumatic and active contact between the teeth and the activator.

Biochemically these experiments seem to be good in harmony with the processes mentioned. It seems as if not only the *function* of the surrounding tissues, but also some mechanical, slightly *traumatic vibrations* are necessary for the deliberation of the inducing substances which lead to the differentiation of the osteoblasts and the osteoclasts. Certainly we do not know the exact nature of these substances, but we know that they are required in order to bring about the osteogenesis and the resorptions. By the pathological trauma, for instance,[5] the fracture callus, these substances probably quite automatically and *mechanically* penetrate the regions of granulation tissue and so bring about the bone formation and the bone resorption. It is a well-known fact that extraction wounds from which the coagulum and the cell debris have been removed may show only a poor healing tendency, because the blood exudates and the disintegrated cells contain all the necessary regenerative substances.

In intact tissue or in tissues which have been only under slight tension or pressure (i.e., not exceeding the limit of the physiological tolerance), the penetration of the osteogenetic-inducing substances occurs only very slowly and by pathways we are not always able to follow exactly, but nevertheless we know that this penetration is regulated by a certain biochemical mechanism.

An important and very often discussed subject is the behavior of the blood vessels to mechanical influence. From the dynamics of inflammation we know that the capillaries are very sensitive to both mechanical, thermic, chemical, and bacterial insults. Their reaction upon these insults instantly appears as a nervous reflex (neurohormonally conditioned by the adrenalin and the acetylcholine), causing a constriction of the capillary walls and a momentary increase of the capillary pressure.

Afterward a dilatation of the capillary walls with hyperemia and decrease of the blood pressure takes place and a certain substance, the leukotoxin, is liberated from the cell walls.[10] The leukotoxin causes an increased capillary cell permeability followed by a penetration of the plasma proteins through the capillary walls and a fibrin coagulation. In other words under pathological con-

ditions the impermeability of the capillary walls to the colloid substances of the blood is not absolute.[11] However, it is questionable if the blood vessels under nonpathological, normal conditions also behave in the same manner. In normal cases we have to imagine the presence of some other substances than leukotoxin, but how these substances are liberated and activated we still ignore. We know some substances which may influence the permeability of the blood vessels, for instance, the tissue hormone, the kallikrein, and the enzyme, the hyaluronidase, which depolymerizes the hyaluronic acid molecules to smaller molecule aggregates, whereby the tough substance is made liquid and permeable. The hyaluronidase activity is furthermore dependent on different inhibitory substances whose nature is still rather unknown (anti-invasin I and II). At any rate it is a fact that the actual state of the capillaries may influence the state of bone tissues and the ossification process.

An anemia with accompanying accumulation of the osteogenetic substances of the blood promotes the bone formation, while the hyperemia accompanies the resorption picture. This is the case in the physiological deciduous tooth resorption, in which hyperemia and increased biological cell activity and cell metabolism dominate the picture to a higher degree than do the pressure stimuli. As is well known, a deciduous tooth root resorption may take place without any stimulus of a permanent successor, in other words without any "pressure atrophy" or other similar problematic ideas. Nor is the tooth eruption due to any pressure effect. It is far more the result of differential growth between teeth and the surrounding bone. It is not the growth of the root which "pushes" the tooth out of the alveolar bone, but rather the rebuilding process of the alveolar bone, which moves the tooth outward. (Cf. the picture of the one hundred soldiers in the rank.)

When it is the question about normal physiological phenomena all the bone-changing processes we generally refer to as mechanically influenced rather seem to be caused by hereditary or hormonal factors, which are able to increase the cell metabolism and stimulate the growth.

On the other hand in pathological conditions in which the mechanical forces assume the character of a trauma with direct destruction of the blood system, with necrosis or in tooth orthodontics where the action always is slightly traumatic we are allowed to speak of the *direct* relation between mechanical force and bone rebuilding.

A *passive* tooth movement like that observed during tooth eruption will never be found in the artificial orthodontics, which is a mechanical, *traumatic overcoming of the hereditary growth predispositions* even if the forces applied are within the physiological limit of tolerance. The only way in which a rational, nonmechanical, passive and biological tooth regulation perhaps might be carried out would be by means of a *biochemical stimulation* of the natural growth processes of the jawbone, f.i., by injection of bone-forming or bone-resorbing substances or by injection of substances increasing the bone-forming compounds of the blood (vitamin D substances promoting the oxidizing processes). But also in this case we have to reckon with great difficulties in overcoming the hereditary factors.

In summary we may express the effects of mechanical stresses to bone in the following way:

1. Forces which are within the limits of tolerance (i.e., determined by hereditary and functional factors) will act to stimulate bone apposition, if they are applied to particular regions and in such direction that they can be regarded as intensified normal forces. This is valid for both pressure and tension.

2. If pressure is applied to a region of bone which normally is under tension, bone resorption will follow.

3. Application of tension in an area which normally is neutral or under pressure is impossible, because the transmission of tension to bone is dependent on the anchoring of ligaments or tendons in the bone.

4. Increase of pressure or tension beyond the limits of tolerance leads to destruction of bone by necrosis or resorption without accompanying apposition.

From several of these facts it appears that the development of the teeth and the jaws occurs independently of each other. In some rare cases of absolute anodontia it could be observed that in spite of the total lack of teeth the jaws developed to normal size. Only the alveolar bone, of course, is dependent in form on the development of the tooth germs and tooth roots, and so becomes resorped. A simple inactivity atrophy including only the processus alveolaris and not the jaw occurs. Biochemically this atrophy may be explained by the fact that the lack of function prevents the bone-inducing substances from penetrating the regions in question.

The expression "pressure atrophy" consequently has to be used with some reservation. Frölich[6] recently in a study tried to describe the difference between (1) not denture furnished and (2) denture-loaded jawbone. He mentioned a "hypoplastic atrophy" (inactivity atrophy) in the first case and a "resorptive atrophy" (pressure atrophy) in the latter case. A more simple explanation may be expressed in the following way: The living teeth generally transmit their functional influence indirectly by traction in the Sharpey's fibers to the processus alveolaris. The artificial dentures, on the contrary, transmit their pressure directly toward the alveolar region, that is, toward a region which is not adapted to resist pressure. Sooner or later a resorption will take place under the artificial denture, while, for instance, the palatinal regions of the jaw do not change in form. Also the mastication without denture on toothless gums will cause the same effect (pressure in tension regions). The jaw itself, however, is adapted by hereditary or functional factors to pressure or neutral mechanical influence and so it keeps its form longer than does the processus alveolaris.

An interesting expression of these facts we also find in the behavior of the different bone grafts to functional influence. A bone graft (autoplastic) which is covered by periosteal or endosteal connective tissue or which contains spongious bone marrow has the best chance of normal healing and incorporation into the surrounding tissues. But even under the most favorable conditions the greater part of the implanted bone tissue will necrotize. The implanted bone, even if it could be kept intact in its entirety, would gradually be replaced by new bone, because the structure of the implanted bone is not, and could never be, functionally adequate.

The structure has to be adapted to the function. In this way the substances which differentiate the osteoblasts and the osteoclasts from the granulation tissues are liberated. The implanted bone becomes subject to a sort of biological modeling which gradually gives it that form which is in harmony with the hereditary and acquired properties of the tissue.

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Editorial

The St. Louis Meeting of 1952

UNDER the able and meticulous direction of President Bernard deVries, the officers, and the hard-working committees, the St. Louis meeting of the American Association of Orthodontists is now past history, and it might be regarded as somewhat of a homecoming event.

The specialty of orthodontics is rather closely associated with the city of St. Louis inasmuch as the late Dr. Edward H. Angle, formerly of St. Louis, was one of the very first to limit his practice to the correction of dentofacial deformities. He founded the Angle School of Orthodontia in 1900, and was the first president of the American Association of Orthodontists, which held its initial meeting here in 1901. In a word, much of the "spade work" of the specialty was done in the city of St. Louis, Mo.

The meeting was well attended (about 700) and reflected great pains and thought on the part of officers and committees. Members and guests attended from all over North America, and there was a goodly representation from the Western Hemisphere.

The president and the chairman of the Program Committee, in close collaboration, followed a plan conceived over a year ago which comprised the bringing together on the same program of essayists who advocate and sponsor various types of treatment. To paraphrase a Washington idiom, "that worked according to plan," and was the first effort of the kind in the history of the American Association of Orthodontists. This part of the program included Oren A. Oliver and his son Bill Oliver of Nashville, Tenn., labiolingual technique; Joseph E. Johnson, of Louisville, Ky., the twin-wire technique; Charles Tweed, of Tucson, Ariz., who spoke about trends in orthodontics, past, present, and future, and the edgewise technique.

If the comments of many attending the sessions are a criterion, the plan of projecting the views of several leaders who advocate varied techniques was interesting and well received, and it is believed served a constructive purpose in an effort to try and coalesce orthodontic thinking, particularly in regard to the problem in hand.

The Monday night stag was headlined by the former football coach of the Chicago Cardinals, and former star professional player, Jimmy Conzelman. The International Luncheon was held Tuesday noon, and the principal speaker was Mr. Roberto de la Rosa, of the Mexican Embassy, with Gerald Franklin, of Canada, presiding.

The Past-Presidents' Luncheon was held on Wednesday noon, and the reception of the current president, deVries, was handled by James D. McCoy, of Beverly Hills, Calif.

Dr. Ben Lischer told the "St. Louis Story" of orthodontics as seen from a "ringside" seat dating from early in the century. Dr. Lischer went back to the days of the first two schools of orthodontics, how they started, and named who the students were. He gave an account of the origin of the prefabricated appliances made of German silver, as used by Angle, Lukens, Canning, and Brady. He revealed detail in regard to the organization of the American Association of Orthodontists, and the subsequent secession in later years of the so-called Angle graduates. He told of the reasons for the split and how it occurred, and, in retrospect, recalled interesting history of the start of the specialty of orthodontics long since passed into the limbo.

The president's reception and banquet were held on Wednesday evening and proved to be a gala occasion. The reception was given in honor of President and Mrs. deVries, and the turnout and entertainment proved to be superb.

One sad note of the meeting was the sudden death of Secretary George Moore, of Ann Arbor, prior to the meeting, and it could not be dismissed from the minds of those who had watched his efficient handling of many details of the meetings in previous years. It was indeed fortunate that Dr. Max Ernst, of St. Paul (a former secretary), could be, and was, drafted to step in to the late Dr. Moore's shoes. Dr. Ernst made a special trip to Ann Arbor just previous to the meeting, secured all the records, and got things well in hand with amazing efficiency.

It has been decided for the first time to publish the program in detail in the News and Notes section of the JOURNAL in order that an all-time record may be made of the subjects discussed by the essayists in the order of their appearance on the program. It is to be hoped that this plan may be followed in subsequent years.

All in all, it may be said that the meeting was one of the very best. The Ketcham Award went to Dr. James D. McCoy, of Beverly Hills, Calif. The newspaper named this Award as the "Oscar" awarded each year in the specialty of orthodontics for outstanding contributions to the specialty.

New officers installed as the convention ended are:

Dr. Brooks Bell, Dallas, Texas	President
Dr. Clare Madden, Greenwich, Conn.	Vice-President
Dr. Franklin Squires, White Plains, N. Y.	Secretary

The president-elect for next year is Dr. James W. Ford, Chicago. The 1953 meeting will be held at Dallas in April.

H. C. P.

Department of Orthodontic Abstracts and Reviews

Edited by

Dr. J. A. Salzmann, New York City

All communications concerning further information about abstracted material and the acceptance of articles or books for consideration in this department should be addressed to Dr. J. A. Salzmann, 654 Madison Avenue, New York City

Modern Trends in Orthodontic Treatment in Children: By K. E. Pringle, L.D.S., R.C.S.(Eng.), *The Medical Press,* July 19, 1950.

"*Every tooth and every dental arch is in a position of equilibrium between the forces that are acting on it;* between the forces of eruption and the forces of occlusion (the bite) in a vertical direction, between the tongue and the lips and cheeks in a horizontal direction, between the forces governing forward movement and the lips and other forces limiting forward movement in an antero-posterior direction.

"*The development, size, form and relations of the basal bones, that is to say the maxilla and the mandible, are practically entirely under the control of hereditary and general causes and are not considered to be changeble with orthodontic appliances.* This should be read as a general statement for there are exceptions.

"In 1933, B. H. Broadbent, of Cleveland, Ohio, introduced a new technique, cephalometric roentgenography. Lateral and frontal radiographs are taken with the X-ray machine at a distance of five feet. The head is held in a craniostat so designed that at a later date further radiographs can be taken with the head in exactly the same position. From the radiographs tracings are made, which can be superimposed on one another. Thus a serial study of the development of any part of the facial area can be made.

"The face and jaws develop downward, forward and outward from the skull. According to modern anatomists, skull and facial growth is at sutures and mandibular growth is at the necks of the condyles. Remodeling by apposition and absorption takes place in other areas to provide sufficient strength of bone to support the muscles.

"*The development, size, form and relations of the dental arches are under the control of general forces but can be greatly altered by local pressures.* By means of plaster models made at intervals serial studies of the changes that occur in occlusion from infancy onwards have been continued over the last twenty years. Notable contributions have come from Friel, Clinch, Chapman, and Sillman. The lower dental arch appears post-normal at birth but it advances rapidly during the next few months. A stable occlusion is not apparent until the deciduous molars erupt. From this time onwards 'normal occlusion' shows a continuous series of changes of relations of the dental arches and the teeth. What are normal relations at one age may be abnormal at another.

"The use of serial models gives opportunities for the prevention of some serious orthodontic irregularities by correct timing of the use of such simple orthodontic procedures as the stoning of deciduous teeth in cases where incorrect locking of cusps prevents a proper occlusion, the extraction of retained deciduous teeth, the application of thumb pressure to an outstanding tooth and the employment of a spatula as a lever to advance an instanding upper incisor. In doubtful cases serial models are of great use in determining the best time for orthodontic treatment. Often under these conditions the treatment can be

very simple indeed. Formerly liable to receive treatment the following conditions are now kept under observation, being regarded as normal variations at their particular ages:

"a. Lower incisors that are slightly crowded and instanding when they first erupt.

"b. A space between the erupting upper central incisors.

"c. A frenum labii attached to the gum on the labial side and apparently causing spacing between the erupting upper central incisors.

"d. Slight malalignment of upper or lower incisors up to ten years of age.

"All these conditions can easily correct themselves. With the eruption of the upper central incisors, the frenum is left high in the sulcus. Frenectomy is rarely considered necessary and is only indicated where there is a thick fibrous band attached to the gum on the palatal side of the incisors.

"The most important local pressures on the dental arches are:

"1. *Oro-muscular pressure.* The size and strength of the tongue and presence or absence of tongue pressure during the physiological movements of deglutition, and possible speech, greatly affect the dental arches.

"There are three ordinary ways of swallowing:

"a. For fluids and semi-solids. Here the teeth are held apart and the tongue is kept low, so as to act as a channel for the fluid. The tongue exerts little or no pressure on the palate.

"b. For solids. Here, as the bolus of the food is passed back, the back teeth are brought together and the tongue is spread against the palatal sides of the upper teeth and the palatal gum covering the alveolus. This gives a firm outward and forward pressure to the upper teeth every time the patient swallows. At the same moment the lips should seal and provide some resistance to the tongue pressure. A clear nasal airway is necessary.

"c. The 'basic swallow' which is continuous at intervals throughout the day and night is similar to that used for swallowing food although the pressures exerted are somewhat lighter. There is light occlusal contact of the cheek teeth with the tongue spread against the palate and sealing of the lips.

"The biggest change that has come about in orthodontics particularly in this country is in the recognition that the whole oral mechanism has to be taken as one. If for any reason a child does not come to swallow in the correct way he will find another way of producing a seal at the front of the mouth during deglutition. A common method is to place the tongue between the upper and lower teeth with the upper and lower lips taking hardly any part in the swallowing act. Nowadays one cannot avoid seeing the intimate connection between all parts of the mouth and the connection does not end there as body posture and breathing also come into the picture. With every variation of muscle behaviour there is a connected orthodontic variation. For example conditions such as a narrow upper dental arch, open bite between the incisors, open bite between the cheek teeth or the deciduous molars, open bite between all the teeth except the molars, full lower prenormal occlusion, many variations of lower postnormal occlusion, prominent upper incisors and bimaxillary protrusion, each condition has its characteristic muscle behaviour. The common characteristic of all is that at the moment of swallowing the tongue fills all the spaces with whatever help it needs and can get from the lips and cheeks.

"Another way of looking at this problem is to emphasize that the change from infantile patterns of muscular behaviour to mature patterns is under the control of the central nervous system and to regard abnormal oro-muscular habits in older children as a failure to mature. By the time the child reaches

say the age of eight and sees an orthodontist the oral conditions which present themselves are abnormal muscular behaviour and an orthodontic abnormality in the dental arches.

"2. *Thumb and finger sucking habits.* These habits produce quite recognizable local abnormalities in the deciduous and permanent dentitions depending on the occlusion and on the way in which the thumb or finger is sucked. Anterior open bite and some labio-clination of upper incisors with retroclination of lower incisors is found. Unless there is also a tongue thrusting habit the teeth go a long way towards self correction when the habit ceases, which it usually does if not too much fuss is made about it. For treatment of thumb-sucking, the monobloc is sometimes used for young children but it is very easily removed and therefore not always successful. More often successful is an upper appliance used at about eight years of age. It is designed to allow air to pass through and thus takes the pleasure out of thumb-sucking. Active appliances designed to correct the inclination of the incisors work well in uncomplicated cases.

"3. *Early extraction of deciduous molars.* The early loss of deciduous teeth affects the dental arches in several ways. Space for permanent teeth is lost by tilting and rotation of adjacent teeth. Vertical incisor overlap is frequently affected. Abnormal 'postural' positions of the mandible are not uncommon. The changes in the dental arches produce marked effects on development of this part of the face. The earlier extractions are performed the greater are the effects. When extractions are performed after eight years of age the results are usually transient. The effects are greater in small or crowded dental arches.

"With careful conservation of the deciduous dentition by fillings, application of silver nitrate and the extraction of only such teeth as are septic the dental surgeon can go a long way towards prevention of such results. It is still too early to assess the results of other methods for the prevention of caries, which are on trial. Removable or fixed space retainers can be of great value in selected cases because space lost through early extractions has often to be regained by the use of appliances before other orthodontic treatment can start.

"The extraction of permanent teeth has very much the same effects but they are more lasting and often change for life the appearance of that part of the face.

"There is a type of treatment of crowded arches known as 'serial extractions' whereby at intervals the planned extraction of deciduous teeth and then permanent teeth gives space for remaining teeth to align themselves. This is a suitable technique for some cases but for successful results it requires a good deal of knowledge and the presence of all deciduous teeth.

"*The movement of teeth with orthodontic appliances is by tilting.* It is perfectly easy to move a tooth by horizontal pressure against its crown and this is all that the removable and fixed appliances in use in England are expected to do, although of course rotation of teeth is also possible. With a horizontal pressure, the crown and most of the root goes in the direction of the force applied and the apex of the root moves in the opposite direction. On the side opposite the force the periodontal membrane is compressed and the alveolar bone is absorbed. On the side on which the force is acting the periodontal membrane stretches and new alveolar bone is laid down. If the force is too great, and particularly is this true of continuous force, there is atrophy of the periodontal membrane and the tooth becomes loose. Intermittent force is now considered to be best for tooth movement but this is apt to be very slow in practice and an appliance using gentle continuous force is often chosen where considerable tooth movement is required.

"*Adequate anchorage is essential when orthodontic appliances are used.* Newton's third law 'To every action there is an equal and opposite action' applies whenever orthodontic force is used. One tooth can be moved using all the other teeth in the same arch as 'anchorage.' The anchorage here will be stable. When, however, one dental arch has to be used as anchorage against the other there is bound to be movement in both.

"The monobloc first described by Robin of Paris, in 1902, and afterwards modified by Andresen working in Norway, came into use in England only during the war. Besides the use already described for the alteration of muscular habits it can be adapted so as to induce a number of tooth movements. It is used for the treatment of lower postnormal occlusion and to a lesser extent for prenormal occlusion. It works well for those types of cases, where the prognosis has always been considered favourable. Evidence is lacking so far that in the way of tooth movement it can do more than active appliances. It has by no means replaced these but is of admitted value, when cooperation is good.

"A method of treatment of cleft palate cases used by Harvold, of Norway with excellent results is being tried in England. The aim is to provide the patient with a palate of normal width by moving back the two portions of the maxilla to the positions they would have occupied had there been no cleft. For this purpose, all the erupted teeth are used as anchorage and with a fixed appliance an outward and backward movement is imparted to each section. Permanent retention in the form of an obturator or fixed bridge is supplied.

"*Some change of forces is necessary, if the result of orthodontic treatment is to be stable.* The old belief in an imaginary stereotyped ideal occlusion suitable for all has been abandoned and the orthodontist now aims to provide the best possible dental mechanism that is natural for his patient. In order to do this he introduces some change in the forces that have previously been acting adversely and at the same time he straightens the dental arches with his appliances if these are needed.

"From what has been said it will be clear that orthodontics has not become a set subject. Many interesting new lines of enquiry are being pursued."

Orthodontic Treatment. (Reprinted from *Brit. D. J.* **88**: 284, May, 1950.)

The subjoined memorandum (E.C.N. 53) on the provision of orthodontic treatment under the General Dental Service has been sent by the Ministry of Health to Executive Councils for circulation to all dentists on their lists.

(1) The following notes have been prepared by the Minister of Health with a view to answering some of the questions which have arisen in relation to the provision of orthodontic treatment under general dental services.

(2) A dentist who has accepted a patient under the general dental services may arrange for another dentist to give, as his deputy, any necessary part of the treatment, including any necessary orthodontic treatment; the deputy need not be on the dental list. The estimate initiated by the dentist who had accepted the patient would be used for the whole treatment. The first dentist would be responsible for all acts and omissions of the deputy: he would claim the appropriate fees from the Executive Council, and be responsible for reimbursing his colleague.

(3) Alternatively, if he is unable (either personally or through a deputy) to provide the necessary orthodontic treatment, he can (under paragraph 4 of his Terms of Service) refer the patient to either:

(*a*) any hospital where such treatment is provided; or

(*b*) to one of his colleagues on the dental list who he knows undertakes such work. If the arrangement in such a case is for the first dentist

to provide all other necessary treatment, and for the second to provide the orthodontic treatment, it helps the Dental Estimates Board if each dentist in submitting his estimate for that part of the treatment which he is providing, will inform the Board of the arrangement with the other.

(4) The words "is unable" in paragraph 4 of the Terms of Service are not defined. While each case would depend on the actual facts, generally the Minister would incline to the view that, where a dentist who had accepted a patient under the general dental services referred the patient (in the way mentioned in paragraph 3) to the hospital service or to another dentist, because he felt that the orthodontic treatment would be provided more satisfactorily and conveniently for the patient in this way, it could not be held that the dentist had committed a breach of his Terms of Service.

(5) It is recognised that, owing to the shortage of dentists who regularly undertake orthodontic treatment and to the fact that the available hospital facilities are limited, it may not always be possible for a dentist who decides to refer one of his patients for orthodontic treatment to another dentist or to the hospital service to ensure that the patient receives such treatment without waiting.

(6) Subject to what is said above, a dentist who has accepted a patient under the Service is obliged to provide all the treatment necessary to secure dental fitness which the patient is willing to undergo.

(7) It may also happen that a dentist, while willing to provide all the necessary treatment, including orthodontic treatment, himself, will wish to have advice, e.g. as to diagnosis and prognosis, before proceeding. Here again, two courses are open:

(*a*) The dentist may refer the patient to a hospital for advice.

(*b*) The dentist may refer the patient to another dentist. In such a case the dentist would need to pay to the other dentist whatever fee is agreed between them for the consultation; in this connection, it should be borne in mind that, in fixing the total fee for the case, the Dental Estimates Board make an allowance for the diagnosis which takes account of the need in some cases for having a second opinion.

(8) The procedure for referring patients to the hospital service is briefly indicated in paragraph 7 of E.C.N. 18.

News and Notes

The 1952 Program of the American Association of Orthodontists

Beginning with the 1952 meeting of the American Association of Orthodontists, it has been decided to publish the complete scientific program of the meeting subsequent to the time the meeting is held. It is thought that such a record published in the JOURNAL each year will serve an important reference in the history of orthodontic meetings.

The following program then is the reproduction of the scientific program as it appeared in the official printed program for the 1952 meeting.

MONDAY MORNING, APRIL 21, 1952

INVOCATION—Reverend Stephen Pronko, Pastor Brentwood Congregational Church

ADDRESS OF WELCOME—Otto W. Brandhorst, D.D.S., St. Louis, Missouri, President-Elect American Dental Association

RESPONSE—Brooks Bell, D.D.S., Dallas, Texas

PRESIDENT'S ADDRESS—Bernard G. deVries, D.D.S., Minneapolis, Minnesota

PROCEDURES FOR CASE EVALUATION AND ANALYSIS

Edward Ray Strayer, D.D.S., Philadelphia, Pennsylvania (deceased)

Synopsis: The author describes what he considers to be adequate material for case evaluation. He advocates the procedure for case analysis as outlined by Strang and gives a detailed description of an appraisal of the lateral head-plate. He describes certain types of Class II, Division I malocclusion based on a study of the teeth and the lateral jaw Xray.

A method of analyzing the proper relation of tooth material to the available apical bony base is described in detail and a unique method of arch predetermination, in the form of a "recording-plex" is shown and discussed. The recording plex is used to plot tooth movement and accurately shows the amount of tooth movement that may be produced laterally and anteroposteriorly without exceeding the boundaries of the apical base. The author feels that no one portion of the material gathered for an analysis and evaluation of a case should be given more attention than the rest. It must all be given careful consideration.

(This paper was prepared in partial fulfillment of the requirements for certification of Dr. Strayer by the American Board of Orthodontics. It was unanimously recommended by the Board for presentation before the American Association of Orthodontists.)

The untimely death of Dr. Strayer on December 16th, 1951, has made it impossible for him to present this paper personally. It will, however, be read by his confrere and friend of long standing, Dr. Will M. Thompson of Pittsburgh, Pennsylvania.

A REAPPRAISAL OF LABIO-LINGUAL THERAPY

Oren A. Oliver, D.D.S., LL.D., and William H. Oliver, D.M.D.

Synopsis: A summary and evaluation of the labio-lingual technic as it is being used today with emphasis on the general reasons for success or failure in using this technic. Emphasis placed upon the use of the occlusal guide plane as an adjunct to the labio-lingual appliance when used in treatment.

Monday Afternoon

A Discussion on Early Treatment Presented by Silas J. Kloehn, D.D.S., and Walter J. Sly, D.M.D.

A New Approach to the Analysis and Treatment of the Mixed Dentition
Silas J. Kloehn, D.D.S., Appleton, Wisconsin

Synopsis: The progress of orthodontics has been determined and follows closely the findings uncovered in research. This has been clearly demonstrated where one plan of treatment has followed another in rapid succession as new facts have been uncovered about the teeth and jaws. Particularly has this influenced the time or age when treatment is instituted. With the increased knowledge of facial growth we have recognized that the most successful results in treatment were obtained when there was good growth during treatment. This can be accomplished with a minimum amount of application and the least amount of tissue disturbance. The philosophy, appliance, and methods of this treatment will be presented.
(This paper was prepared in partial fulfillment of the requirements for certification of Dr. Kloehn by the American Board of Orthodontics. It was unanimously recommended by the Board for presentation before the American Association of Orthodontists.)

Synchronizing Treatment with Development
Walter J. Sly, D.M.D., Boston, Massachusetts

Synopsis: It will be the purpose of this presentation to demonstrate the advisability of keeping the dentition within the normal physiological limits for the age of the individual. Special emphasis will be given to function as a factor in the process of development.

How and Where Does Heredity Fit Into the Orthodontic Picture?
Wilton Marion Krogman, Ph.D., Professor of Physical Anthropology, Graduate School of Medicine and Evans Institute of Dentistry, University of Pennsylvania, Philadelphia, Pennsylvania

Synopsis: A given malocclusion involves many biological factors: inter-dental and intra-dental patterns; structural and functional relationships between several bones of the face and head; the whole problem of growth timing, involving rate of growth in tooth and bone units and facio-dental growth as a complex. The foregoing are component parts of the major question as to whether or not there is such a thing as tooth and/or bone *unit* in malocclusion, or whether the denofacial disharmony is part of the growth syndrome, as it were. Either way problems of heredity are involved but especially in the former (unit).
We must look at evidence of several kinds; 1) experimental or controlled, as in studies by Stockard and others; 2) clinical or observational, as in family line studies or transmission. For practical purposes the orthodontist must learn to follow the leads he gets under 2); to place the child in a familial complex (paternal and maternal lines) and hence to anticipate in a given child at least the potentiality of harmonious or disharmonious dento-facial development.

Tuesday Morning, April 22

Program Conducted by Research Committee

J. A. Salzmann, D.D.S., New York City, *Chairman*
Robert E. Moyers, D.D.S., M.S., Ph.D., Toronto, Ontario
John R. Thompson, D.D.S., M.S.D., Chicago, Illinois, *Presiding*

I. Contributions From Orthodontic Department, University of California:
Rapid Evaluation of Facial Dysplasia in the Vertical Plane. E. L. Johnson, D.D.S., and Wendell L. Wylie, D.D.S., M.S.
Facial Pattern in Malocclusion. Eugene E. West, D.D.S.

II. Contributions From Orthodontic Department, University of Illinois:
The Integration of Facial Variation: A Serial Cephalometric Roentgenographic Analysis of Cranio-Facial Form and Growth. S. Eugene Coben, D.D.S.
A Cephalometric Appraisal of the Class III Skeletal Pattern as Compared to that Exhibiting Excellent Occlusion. Richard T. Sanborn, D.D.S.
Early Changes Following Tooth Movement in Rats. Luz Macapanpan, D.M.D.
A Cephalometric Investigation of Central Australian Aborigines Using a Roentgenographic Technique. A. H. Craven, B.D.S., D.D.S.
The Application of Frontal Laminagrophy to the Study of Naso-Pharyngeal Development in Normal and Cleft Palate Children. J. Daniel Subtelny, B.S., D.D.S.
Further Studies on the Morphology of Angle Class I, Class II, Division I, and Class II Division II Malocclusions. E. S. Blair, D.D.S.
A Study of Changes in Temporomandibular Relations Associated With the Treatment of Class II Malocclusions (Angle). Robert Murray Ricketts, D.D.S., M.S.
Effects of Cheiloplasty on the Maxillary Arch in Newborns With Complete Bilateral Cleft Lip and Cleft Palate. S. Pruzansky, D.D.S., M.S.
Alterations in the Masticatory Mechanism as a Consequence of Bulbar Poliomyelitis. S. Pruzansky, D.D.S., M.S.

III. Contributions From Orthodontic Department, University of Michigan:
An Observation Which May Clarify the Location of Bolton Point in Oriented Cephalometric Radiographs. John A. Henkel, D.D.S., M.S., David W. Baumgartner, D.D.S., and William M. Ditto, B.S., D.D.S.
An Electronic Technique Permitting Multiple Registration of Oral Myodynamics. James P. Alderisio, B.S., D.D.S., and Roy J. Lahr, Senior Student in Electrical Engineering.

IV. Contributions From Orthodontic Department, Northwestern University:
A Serial Radiographic Study of Velopharyngeal Closure and Tongue Position in Certain Vowel Sounds. Robert L. Williams, D.D.S., M.S.D.
A Radiographic Study of the Positions of the Mandibular Condyle at Physiologic Rest Position and at Occlusion of the Teeth in Individuals Possessing Cleft Palate Deformity. Arthur P. Arnstine, D.D.S., M.S.D.
A Cephalometric Radiographic Study of the Change in Relation of Mandible to Maxilla in Orthodontic Treatment. Stanley D. Carlson, D.D.S., M.S.D.
A Metallographic Study of the Bond Between Stainless Steel and Silver Solder. Robert J. Henns, D.D.S., M.S.D.
A Radiographic Cephalometric Study of the Labio-lingual Axial Inclination of the Central Incisors in Relation to the Mandible and Maxilla of Excellent Dentitions. James E. Williams, A.B., D.M.D., M.S.D.
A Cephalometric Radiographic Method of Classification of the Facial Structures in the Sagittal Plane. Robert W. Donovan, D.D.S., M.S.D.
An Apparatus and Technique for Temporomandibular Radiography. Robert W. Donovan, D.D.S., M.S.D.
The Growth of the Face and the Cranium of a Rat in an Experimentally Produced Distal Occlusion. Joseph R. Jarabak, D.D.S., M.S.
Cuspal Height and Its Effect on the Production of an Experimental Distal Occlusion. Joseph R. Jarabak, D.D.S., M.S.
Further Studies on Stability of Rest Position of the Mandible and Path of Closure From Rest Position to Occlusal Position. John R. Thompson, D.D.S., M.S.D.
The Influence of Increments, Time and Direction of Facial Growth on Orthodontic Therapy. Robert W. Donovan, D.D.S., M.S.D.

V. Contributions From Orthodontic Department, University of Toronto:
Influence of Function on the Growth of Cranio-Facial Complex and Mandible of the Kitten. Lawrence Funt, D.D.S., M.Sc.
A Cephalometric Morphologic Study of Class II, Division II, Malocclusion and

Its Response to Treatment. G. C. Swann, D.D.S., M.Sc.

The Role of Dental Caries in Space Closure in the Mixed Dentition. Albert Jarvis, D.D.S., M.Sc.

VI. Contributions From Orthodontic Department, Tufts College:

A Photo-electric Myodynagraph for Directing Recording of Oral Muscle Forces. Herbert I. Margolis, D.M.D., Prem. Prakash, D.M.D., M.S., and Kenneth Fried, D.M.D., M.S.

An Electro-myographic Method for the Measurement of the Function of Human Lips. Herbert I. Margolis, D.M.D., Prem. Prakash, D.M.D., M.S., and Kenneth Fried, D.M.D., M.S.

A Study of Lip and Tongue Forces on the Dental Arch in Children With Normal Occlusion and With Malocclusion, a Preliminary Report. Herbert I. Margolis, D.M.D., Prem. Prakash, D.M.D., M.S., and Kenneth Fried, D.M.D., M.S.

Relation of Speech Defects and Malocclusion. Murray Bernstein, D.M.D., M.S.

VII. Contributions From Orthodontic Department, University of Washington:

Certain Craniofacial Differences in Children Possessing Excellent Occlusion and Class II, Division I Malocclusion. Milton Yellen, D.D.S., M.S.

An Analysis of the Extent and Direction of Tooth Movement Resulting From the Use of a Maxillary Removable Appliance in the Treatment of Class I and Class II Malocclusions in Which Teeth Were Extracted. Gerald N. Dohner, D.M.D.

A Cephalometric Study of Excellent Occlusion and Class I Malocclusion of Children and Adults. Benedict J. Petraitis, D.D.S., M.S.

The Morphology of the Mandible in Class II, Division I Malocclusion as Compared to Excellent Occlusion in Children. W. J. Shoverling, D.D.S., M.S.

A Study of Variations in Facial Relationships in the Adult Nisei With Excellent Occlusions. William S. Takano, D.D.S., M.S.

A Study of the Controllable Variants in the Production of Acceptable Human Head Radiographs and a Proposed Method for Their Control. Kenneth S. Kahn, D.D.S., M.S.

An Evaluation of the Types and Degree of Orthodontic Tooth Movement Achieved Through the Use of a Maxillary Removable Appliance. Warren K. Orman, D.D.S., M.S.

Disharmony in Tooth Size and Its Relation to the Analysis and Treatment of Malocclusion. Wayne A. Bolton, D.D.S., M.S.

A Cephalometric Evaluation of the Results of Orthodontic Treatment in Class II, Division I Malocclusion Case. Paul H. Stephens, D.D.S., M.S.

PRIZE ESSAY—Award presented to the 1952 recipient by J. A. Salzmann, D.D.S.

INTERNATIONAL LUNCHEON—GOLD ROOM.

Gerald Franklin, D.D.S., Montreal, Quebec, Canada, presiding.

Speaker—Mr. Roberto de la Rosa, Cultural Agent for the Mexican Government, Mexican Embassy, St. Louis, Missouri.

TUESDAY AFTERNOON

PRESENT BELIEFS IN THE PRACTICABILITY OF CEPHALOMETRIC STUDIES IN INDIVIDUAL CASE ANALYSIS, PROGNOSIS, AND TREATMENT.

Wendell L. Wylie, D.D.S., M.S., San Francisco, Calif.

Synopsis: Cephalometric films may profitably be added to records already in prevalent use—plaster casts, frontal and lateral photographs, intra-oral films—*as adjuncts to an observant examination of the patient himself,* in order to achieve completeness in patient evaluation and to broaden the outlook of the orthodontist. The comparison of a given patient in quantitative terms against intelligent standards, and the evaluation of a particular child against his own past record are made

possible with this technique of examination. An initial investment of time spent in study of cephalometry's implications makes it possible to use the technique routinely without undue expenditure of time.

PRESENTATION OF THE ALBERT H. KETCHAM MEMORIAL AWARD BY THE AMERICAN BOARD OF ORTHODONTICS.

This Memorial Award is awarded to a person who, in the judgment of the award committee, has made a notable contribution to the science and art of Orthodontics. This year the Award will be presented to Dr. James David McCoy, Beverly Hills, California.

EVOLUTIONARY TRENDS IN ORTHODONTICS—PAST, PRESENT AND FUTURE.
Charles H. Tweed, D.D.S., Tucson, Arizona.

Synopsis: The clinical orthodontist is not keeping abreast with orthodontic research. All of us have patients under observation in the mixed dentition stage. Is it remotely scientific casually to watch the development and completion of a severe malocclusion, to observe nature exhausting herself in the effort of erupting all of the permanent teeth, displaced in all directions except the correct ones, when we have the "know-how" to prevent such a happening? How long will it be before we intercept the development of the malocclusions occurring in discrepancy cases by removal of unerupted premolars and allow nature to do more than half of our treatment for us, etc.?

WEDNESDAY MORNING, APRIL 23

CONSIDERATION OF MUSCULATURE IN DIAGNOSIS, TREATMENT AND RETENTION.
Allan G. Brodie, D.D.S., Ph.D., Chicago, Illinois.

Synopsis: The point will be stressed that the teeth, upon erupting into the mouth, emerge from an environment that is completely protected into one in which their positions, and hence their functions, are almost completely dominated by muscular factors. If these muscular factors and forces are in functional equilibrium and if the bony framework which supports the teeth enjoys adequate development a normal relation of the teeth can be expected. If, on the other hand, there is a disturbance in any of these various conditions the result can only be malocclusion. It is one of the orthodontist's major tasks to assess conditions of the muscular disharmony and to attempt to correct them during the course of treatment and to guard against them during the period of retention.

A CONSIDERATION OF THE PRESENT DAY USE OF THE TWIN WIRE MECHANISM AS EMPLOYED WITH THE TUBULAR AND STAPLE LINGUAL ARCHES FOR EXPANSION.
Joseph E. Johnson, D.D.S., Louisville, Kentucky.

Synopsis: A recapitulation of the advantages of the twin-wire mechanism and the tubular and lingual arches after twenty-four years of use.

NATURE—HEART DOCTOR EXTRAORDINARY.
Thomas J. Dry, B.A., M.A., M.B., Ch.B., (University of Cape Town) M.S. in Medicine, (University of Minnesota). Head of the Section on Cardiology, Mayo Clinic, Professor of Medicine, Mayo Foundation Graduate School, University of Minnesota.

Synopsis: Medical science and public health measures have improved our chances of living to a ripe old age. Such advances have been most noticeable in the broad fields of infectious and industrial diseases but like advances against the so-called degenerative diseases such as arteriosclerosis (hardening of the arteries) are not yet in evidence. In fact coronary heart disease (hardening of the arteries of the heart itself) poses as the greatest challenge to medical science today.
One aspect of this broad subject has not been sufficiently emphasized or appreciated. It is the role contributed by nature's own efforts in making adjustments whenever

the vital circulation to the heart itself is jeopardized by hardening of its arteries, thereby prolonging life.

PAST PRESIDENTS' LUNCHEON. Room 8.
H. C. Pollock, D.D.S., presiding.

WEDNESDAY AFTERNOON

2:00 P.M. to 5:00 P.M. GENERAL CLINICS.

INDIVIDUAL CLINICS

"Simplified Edgewise Technic." Dr. Clifford L. Whitman, Hackensack, N. J.

"Some Helpful Suggestions in the Use of the Universal Appliance (Atkinson)." Dr. Robert J. Gawley, Alhambra, Calif.

"Removable Appliance for Moving Posterior Segment, Maxilla, or Mandible, Distally (Kickback Appliance). Also Space Closing Removable Appliance." Dr. Harry V. Banks, Denver, Colo.

"Head Caps and Other Auxiliaries to Accomplish Tooth Movements." Dr. S. James Krygier, Wilmington, Delaware.

"Early Extraction." Dr. Z. Bernard Lloyd, Washington, D. C.

"Practical Advantages of the 'Loop Arch.'" Dr. Norris C. Leonard, Nashville, Tenn.

"Compressed Air Swaging Technic in the Construction of Acrylic Retainers." A. Construction of Plain Retainers. B. Construction of Inclined Plane Retainers. C. Construction of Retainers Restoring Lost Dental Units.
Dr. Russell T. Goldsmith, Chairman, Houston, Tex.; Dr. George Raycraft, Houston, Tex.; Dr. Joe Favors, Dallas, Tex.; Dr. Frank Roark, Dallas, Tex.

"Completion of Difficult Deep Overbite Cases." Dr. Lloyd H. Chapman, Vancouver, B. C.

"Several Types of Malocclusions Treated With the Edgewise Appliance." Dr. M. B. Smith, McAllen, Texas.

"Experimental Orthodontic Attachments." Dr. C. W. Volckmer, Williamsport, Pa.

"Technique of Treatment in Class II, Division 1 Malocclusion Discrepancy Cases as Used by Cuban Tweed Study Group."
Dr. Carlos Coro, Margarita Coro, Dr. Frederico Rodriguez de la Rosa, Dr. Pablo Vallhonrad, Dr. Dario Gandaria, Dr. Antonio Gonzalez Cabrera.

"Combined Progressive Clinic Illustrating With Typodonts Class II, Division 1 Treatment With Removal of Dental Units." Dr. William M. Tweed, Tucson, Ariz., Dr. Robert Payne, Phoenix, Ariz., Dr. Melvin Saxman, Phoenix, Ariz., Dr. Richard Moffat, Phoenix, Ariz., Dr. Robert Felix, Tucson, Ariz., Dr. F. G. Heisser, Safford, Ariz., Dr. G. H. Garson, Hollywood, Calif.

"Mixed Denture Treatment Pros and Cons." Dr. Raymond Curtner, San Francisco, Calif.

"Is the Mechanical Expansion of the Dental Arch Permanent?" Dr. J. A. Burrill, Wilmette, Ill.

"Cases Treated With Extra-Oral Anchorage." Dr. Beulah G. Nelson, Oak Park, Ill.

"Class II—1 Treatment in the Deciduous Dentition." Dr. M. Edward Maule, Waterloo, Iowa.

"Extra Oral Anchorage With the Johnson Twin Wire Appliance." Dr. W. Manfred Jacobsen, Minneapolis, Minn.

"Construction and Specific Use of the Crozat Removable Appliance, Including Some Additions and Modifications." Dr. Andrew Francis Jackson, Philadelphia, Pa.

"Modified Hawleys." Dr. Maynard E. Cook, Austin, Minn.

"Molar Band Occlusal Rest." Dr. Martin J. Mayeau, Wheaton, Ill.

"A Removable Appliance for Distal Movement of the Upper First Molar." Dr. Samuel Ackerman, Cincinnati, Ohio.

"Economic Management Indigenous to Successful Therapy." Dr. Leonard P. Wahl, Wausau, Wisconsin.

"Results of Treatment Following the Tweed Philosophy." Dr. Ben L. Herzberg, Chicago, Ill., Dr. Walter Epstein, St. Louis, Mo., Dr. Melvin M. Meilach, Chicago, Ill., Dr. Beulah G. Nelson, Oak Park, Ill., Dr. Lewis Robinson, Youngstown, Ohio, Dr. Louis Tinthoff, Peoria, Ill., Dr. Walter W. Winter, Decatur, Ill.

"Some Practical Uses and Suggestions for You." Dr. Martin Snyderman, Pittsburgh, Pa.

"Extra-Oral Anchorage—Applied Clinically." Dr. Arthur J. Block, Chicago, Ill.

"Orthodontic Records." Dr. Edgar T. Haynes, Indianapolis, Ind.

"Treated Cases." Dr. Robert B. Murray, Berkeley, Calif.

"Consecutively Treated Cases—High Labial and Lingual Arch Wires." Dr. Holly Halderson, Toronto, Ont., Canada.

"Fifty Cases Treated Without Retention and According to Concepts of Charles Tweed Foundation." Dr. George L. Englert, Danville, Ill.

"Deliberate Mesial Movement of Posterior Teeth in First Bicuspid Extraction Cases." Dr. C. Edward Martinek, Detroit, Mich.

"Retainers That Patients Will Wear." Dr. James C. Brousseau, Baton Rouge, La.

"A Simplified Technic for Oral Photography." Dr. Edward E. Johns, Kingston, Ont., Canada.

"Latex Separations." Dr. Michael J. Maxian, Manhasset, L. I.

"Removal of Maxillary Second Molars as an Aid in the Reduction of Superior Protractions." Dr. Malcolm R. Chipman, Spokane, Washington.

"An Edgewise Auxiliary for Retracting Anterior Teeth." Dr. E. W. Hodgson, St. Louis, Missouri.

UNIVERSITY CLINICS

University of Southern California

"The Mesial Buccal Root of the Maxillary First Molar." Dr. George N. Boone, Dr. Herbert V. Muchnic, Los Angeles, Calif.

Indiana University

"The Polygon as a Graphic Means of Expressing Cephalometric Analysis." Dr. J. William Adams, Dr. Jack M. Vorhies, Indianapolis, Ind.

University of Tennessee

"An Efficient, Economical Photographic Setup for Clinical Orthodontics. Orthodontic Treatment of Cleft Palate Cases. Mixed Dentition Treatment With the Headcap." Dr. Walter C. Sandusky, Dr. Ralph E. Braden, Dr. Faustin N. Weber, Memphis, Tenn.

University of Washington

"A Cephalometric Appraisal of Orthodontic Treatment." Richard A. Riedel, Seattle, Wash.

St. Louis University

"Rehabilitation of the Cleft Palate." Dr. Paul Gibbons, Dr. Gus G. Sotiropoulos.

"An Understanding of the Changes in the Curve of Spee in Class I and Class II Cases." Dr. William Schmidt, Dr. Milton L. Braun.

"Treated Cases." Dr. George S. Uchiyama, Dr. Walter W. Winter.

"Diagnostic Methods Employed in the Graduate Department." Dr. Quentin Ringenberg, Dr. Howard Strange.

"Undergraduate Orthodontics." Dr. K. C. Marshall and Staff.

"Occlusal Equilibration Following Orthodontic Treatment." Dr. John Byrne, Dr. Elmer O. Sunderman.

"Case Report." Dr. Jose Rivera.

"The New Graduate Orthodontic Clinic."

Washington University

"A Series of Clinics by Seminar Students of Washington University School of Dentistry, Demonstrating Methods and Procedures used in Undergraduate instruction in the Departments of Dental Pediatrics and Orthodontics."
(Given under auspices of the staffs of these Departments)

Thursday Morning, April 24

SYMPOSIUM PRESENTED BY DR. MOYERS AND ASSOCIATES

This symposium has been prepared for the purpose of attempting a codification of some of the fundamental principles which underlie orthodontic practice. It has been undertaken as a project by the University of Toronto, Faculty of Dentistry, Department of Orthodontics. The symposium is under the direction of Robert E. Moyers, D.D.S., M.S., Ph.D., head of the department. Each individual paper has been prepared by a team of staff members.

Three important inter-related fields have been surveyed and an analysis made of our present knowledge of each. An attempt has been made to separate facts from fancy, research findings from traditionally accepted ideas, and proven knowledge from legends. In addition the group has defined those areas wherein our knowledge is incomplete to try and point out the direction of future studies.

The Morphology and Physiology of Distocclusion—A Summary of Our Present Knowledge

G. V. Fisk, D.D.S., M. R. Culbert, D.D.S., R. M. Grainger, D.D.S., M.S., B. Hemrend, D.D.S.

The introduction by Angle of the classification of malocclusion did much to clarify thinking and modify treatment procedure. Such a large percentage of clinical problems are Class II that the literature is filled with papers about these cases. The present paper is an evaluative summary of articles describing the clinical entity known as Class II or distocclusion.

The Timing of Treatment in Orthodontics—A Summary of Our Present Knowledge

D. H. Jenkins, B.S.Sc., D.D.S., J. T. Crouch, D.D.S., M.S., W. K. Shultie, D.D.S., L. E. Riddolls, D.D.S., G. Nikiforuk, D.D.S., M.S.

Treatment is undertaken to prevent an anomaly developing or to correct an anomaly at the time offering the maximum advantage to the patient. At each age physiological considerations affect the course of orthodontic therapy. This paper surveys the work reported thus far in the literature on the timing of orthodontic treatment. It also defines important areas where our knowledge is, as yet, incomplete.

The Selection of Forces for Tooth Movement—A Summary of Our Present Knowledge

H. Halderson, D.D.S., E. E. Johns, D.D.S., R. E. Moyers, D.D.S., M.S., Ph.D.

Teeth move and are moved in several ways. Some movements are easily obtained, others are more difficult. The restraints to movement are not all mechanical, in fact they are largely physiological. This paper attempts to define and codify the physiological limitations to the various tooth movements and to show how appliance must conform to the restrictions imposed by tissues. The evolution of appliance design and manipulation is largely a result of our haphazard acquirement of knowledge on this subject.

A. A. O. OFFICERS, 1952 MEETING

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MALCOLM R. CHIPMAN - - - - - - - - - - - - - - - - - - Spokane, Washington

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- Officers of the Association
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- Directors elected by Constituent Societies

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SESSIONS OF AMERICAN ASSOCIATION OF ORTHODONTISTS

Year	*Presidents*	*Secretaries*	*Places of Meeting*
1901	*Edward H. Angle	Milton T. Watson	St. Louis
1902	*Edward H. Angle	Milton T. Watson	Philadelphia
1903	*Milton T. Watson	Anna Hopkins	Buffalo
1904	Lloyd S. Lourie	Anna Hopkins	St. Louis (Int'l Dental Cong.)
1905	Lloyd S. Lourie	Anna Hopkins	Chicago
1906	*R. Ottolengui	Frederick S. McKay	New York
1907	*Herbert A. Pullen	Frederick S. McKay	Detroit
1908	*Charles A. Hawley	Frederick S. McKay	Washington
1909	Frank M. Casto	F. C. Kemple	Cleveland
1910	*B. Frank Gray	F. C. Kemple	Denver
1911	Alfred P. Rogers	F. C. Kemple	Boston

1912	*Milton T. Watson	F. C. Kemple	Chicago
1913	B. E. Lischer	F. C. Kemple	Chicago
1914	*Guy B. Hume	W. E. Walker	Toronto
1915	*Frederick C. Kemple	W. E. Walker	San Francisco
1916	*Frederick C. Kemple	F. M. Casto	Pittsburgh (Int'l Dental Cong.)
1917	*M. N. Federspiel	F. M. Casto	Excelsior Springs
1918	D. Willard Flint	F. M. Casto	Chicago
1919	O. W. White	F. M. Casto	St. Louis
1920	John V. Mershon	F. M. Casto	Chicago
1921	*J. Lowe Young	Ralph Waldron	Atlantic City
1922	*Martin Dewey	Ralph Waldron	Chicago
1923	*Burt Abell	W. H. Ellis	Chicago
1924	Ralph Waldron	W. H. Ellis	Kansas City
1925	Clinton C. Howard	W. H. Ellis	Atlanta
1926	*William C. Fisher	W. H. Ellis	New York (First Int'l Ortho. Cong.)
1927	Joseph D. Eby	Charles R. Baker	Chicago
1928	Walter H. Ellis	Charles R. Baker	Buffalo
1929	*Albert H. Ketcham	Charles R. Baker	Estes Park
1930	Oren A. Oliver	Charles R. Baker	Nashville
1931	*Harry E. Kelsey	Claude R. Wood	St. Louis
1932	Charles R. Baker	Claude R. Wood	Toronto
1933	W. E. Flesher	Claude R. Wood	Oklahoma City
1935	L. M. Waugh	Claude R. Wood	New York
1936	H. C. Pollock	Claude R. Wood	St. Louis
1937	P. G. Spencer	Claude R. Wood	Chicago
1938	James D. McCoy	Claude R. Wood	Los Angeles
1939	*Frank A. Delabarre (Posthumously)		
1939	*Harry A. Allshouse, Jr.	Claude R. Wood	Kansas City
1940	William A. Murray	Claude R. Wood	Chicago
1941	*Henry U. Barber, Jr.	Max E. Ernst	New York
1942	Claude R. Wood	Max E. Ernst	New Orleans (Inter-American Cong.)
1944	James A. Burrill	Max E. Ernst	Chicago
1946	Archie B. Brusse	Max E. Ernst	Colorado Springs
1948	Earl G. Jones	Max E. Ernst	Columbus, Ohio
1949	Lowrie J. Porter	George R. Moore	New York
1950	Max E. Ernst	George R. Moore	Chicago
1951	Joseph E. Johnson	*George R. Moore	Louisville, Ky.
1952	Bernard G. de Vries	------------	St. Louis, Mo.

*Deceased.

1952

IN MEMORIAM

Members of the American Association of Orthodontists who have died since the 1951 session.

Charles M. Alderson - - - - - - - - - - - - - Los Angeles, California
William P. Delafield - - - - - - - - - - - - - - - - Dallas, Texas
Matthew N. Federspiel - - - - - - - - - - - - - Milwaukee, Wisconsin
Adelbert Fernald - - - - - - - - - - - - - - Newton, Massachusetts
Moe B. Markus - - - - - - - - - - - - - - - Philadelphia, Pennsylvania
Roy G. Roberts - - - - - - - - - - - - - - - - Wichita Falls, Texas

Moses B. Rubin	Brooklyn, New York
Clayton A. Sayers	Syracuse, New York
Charles A. Spahn	Newark, New Jersey
Edward Ray Strayer	Philadelphia, Pennsylvania
Kirman E. Taylor	Denver, Colorado
George R. Moore	Louisville, Kentucky

Ladies' Entertainment Committee, American Association of Orthodontists

The forty-eighth annual meeting of the A.A.O. got off to a good start Sunday evening, April 20, with an informal buffet supper in the Gold Room of the Hotel Jefferson, with an attendance of 336 men and women. On Monday evening 160 ladies were entertained with a cocktail party, which included breast of guinea hen, at the University Club. There was no formal program, and the evening was spent in renewing old friendships and making new acquaintances. The cochairman of the Ladies' Entertainment Committee, with the wives of the officers of the A.A.O., the wives of the presidents of the sectional societies, and the wife of the president of the A.B.O., acted as hostesses for the occasion. They were ably assisted by the wives of the local orthodontists.

At one o'clock on Tuesday 152 ladies attended a luncheon and radio show in the Gourmet Room of the Park Plaza Hotel. On the quiz show many of the wives were given an opportunity to show their knowledge of orthodontic terminology. Many beautiful and valuable prizes were awarded to those in attendance.

The high light of the meeting was the President's Reception and Banquet on Wednesday evening, which was attended by 382 people.

Earl C. Bean.

American Board of Orthodontics

The annual session of the American Board of Orthodontics was held April 16, 17, 18, 19, 20, 1952 at the Jefferson Hotel, St. Louis, Missouri.

Stephen C. Hopkins, *President*	1746 K St., N.W., Washington, D. C.
Leuman M. Waugh, *Vice-President*	931 Fifth Ave., New York, N. Y.
C. Edward Martinek, *Secretary*	661 Fisher Bldg., Detroit, Mich.
Reuben E. Olson, *Treasurer*	712 Bitting Bldg., Wichita, Kan.
Raymond L. Webster	133 Waterman St., Providence, R. I.
Ernest L. Johnson	450 Sutter St., San Francisco, Calif.
Lowrie J. Porter	41 E. 57th St., New York, N. Y.

THE ALBERT H. KETCHAM MEMORIAL

Established by the American Board of Orthodontics in collaboration with the American Association of Orthodontists in 1936.

AWARDS

1937	John Valentine Mershon	1944	B. Holly Broadbent
1938	Alfred Paul Rogers	1946	Raymond Clair Willett
1939	Milo Hellman	1948	Clinton C. Howard
1940	George Wellington Grieve	1949	William K. Gregory
1941	Frederick Bogue Noyes	1951	Benno E. Lischer
1942	Harry E. Kelsey	1952	James David McCoy

At the A. B. O. meeting in St. Louis the new director chosen for a term of seven years to replace Stephen C. Hopkins, whose service expired, was Max E. Ernst, Lowry Medical Arts Bldg., St. Paul, Minn.

The Board announces with regret the resignation of Director Reuben E. Olson, Wichita, Kan. To fill his unexpired term for two years the Board appointed William E. Flesher, Oklahoma City, Okla.

The Board placed the following tributes in its Minutes:

"Upon the retirement from the Board of our Treasurer, R. E. Olson, after five years of faithful service, we desire to have recorded in the Minutes of the Board our appreciation of his sterling qualities in the advancement of the specialty of Orthodontics."

"Upon the retirement from the Board of our President, Stephen C. Hopkins, after a service extending over a period of six years, his fellow directors desire to have recorded in the Minutes their deep appreciation of his untiring devotion and outstanding leadership for the uplift of Orthodontics for the service of humanity."

The following sixty candidates were certified at the 1952 meeting.

Dr. Samuel Ackerman	332 Doctors Bldg.	Cincinnati, Ohio
Dr. John A. Atkinson	896 Starks Bldg.	Louisville, Ky.
Dr. Earl Calvin Bean	120 N. Forsyth St.	St. Louis, Mo.
Dr. Carl F. Bruggeman	10845 Lindbrook Dr.	Los Angeles, Calif.
Dr. Curtis E. Burson	1232 Republic Bldg.	Denver, Colo.
Dr. Peter J. Ceremello	1904 Franklin St.	Oakland, Calif.
Dr. Lloyd Chapman	925 W. Georgia	Vancouver, B. C.
Dr. Edward A. Cheney	320 W. Ottawa St.	Lansing, Mich.
Dr. Horace P. Clark	455 W. State St.	Trenton, N. J.
Dr. Arthur M. Corn	88-56—163rd St.	Jamaica 3, N. Y.
Dr. Raymond M. Curtner	450 Sutter St.	San Francisco, Calif.
Dr. Howard N. Delbridge	407 Goodwin Block	Beloit, Wis.
Dr. Herbert G. Frankel	353 Doctors Bldg.	Cincinnati, Ohio
Dr. Lawrence B. Gilling	410 Bellin Bldg.	Green Bay, Wis.
Dr. Marvin C. Goldstein	514 Grant Bldg.	Atlanta, Ga.
Dr. Chas. J. Goldthwaite	332 Main St.	Worcester, Mass.
Dr. Rudolph O. Gothenquist	707 Seaboard Bldg.	Seattle, Wash.
Dr. Irving Grenadier	888 Grand Concourse	New York, N. Y.
Dr. Geo. S. Harris	7-266 General Motors Bldg.	Detroit, Mich.
Dr. Carlotta A. Hawley	915 Nineteenth St., N.W.	Washington, D. C.
Dr. Sylvester J. Hecht	16 Broad St.	Red Bank, N. J.
Dr. Albert C. Heimlich	1824 State St.	Santa Barbara, Calif.
Dr. Russell A. Hering	324 E. Wisconsin Ave.	Milwaukee, Wis.
Dr. V. Everett Hunt	707 Eye St.	Eureka, Calif.
Dr. Theo. L. Jerrold	131 Fulton Ave.	Hempstead, N. Y.
Dr. Chas. S. Jonas	101 S. Indiana Ave.	Atlantic City, N. J.
Dr. Roscoe L. Keedy	880 E. Colorado St.	Pasadena, Calif.
Dr. A. Richard King	808 Ridgely Bldg.	Springfield, Ill.
Dr. Edw. C. King	Seneca Bldg.	Ithaca, N. Y.
Dr. Benjamin C. Ledyard, Jr.	950 The Alameda	San Jose, Calif.
Dr. Arthur B. Lewis	804 Hulman Bldg.	Dayton, Ohio
Dr. Edw. A. Lusterman	253 Sunrise Highway	Rockville Centre, N. Y.
Dr. David Marshall	713 E. Genesee St.	Syracuse, N. Y.
Dr. Theo. S. Martin	1012 So. Robertson Blvd.	Los Angeles, Calif.
Dr. Milton J. Meyers	281 Haverhill St.	Lawrence, Mass.
Dr. Herbert V. Muchnic	9615 Brighton Way	Beverly Hills, Calif.
Dr. Herbert H. Mueller	312 Exchange Bldg.	LaCrosse, Wis.
Dr. Robt. B. Murray	2235 Channing Way	Berkeley, Calif.
Dr. Eugene L. Neuger	2010 E. 102nd St.	Cleveland, Ohio
Dr. Lowell T. Oldham	307 Brick & Tile Bldg.	Mason City, Iowa
Dr. Robert D. Payne	311 W. McDowell Road	Phoenix, Ariz.
Dr. John H. Parker	2241 Central Ave.	Alameda, Calif.
Dr. Howard W. Peterson	510 Sinclair Bldg.	Steubenville, Ohio
Dr. Richard C. Philbrick	4th & Pike Bldg.	Seattle, Wash.

Dr. Denton J. Rees	901 Selling Bldg.	Portland, Ore.
Dr. Francis M. Schneider	240 Bradley St.	New Haven, Conn.
Dr. Fred F. Schudy	2626 Westheimer	Houston, Texas
Dr. Joseph Schure	1 Hanson Place	Brooklyn, N. Y.
Dr. Joseph A. Sheldon	U. S. Army Hospital	Fort Benning, Ga.
Dr. Cecil C. Steiner	153 South Lasky Dr.	Beverly Hills, Calif.
Dr. Arnold E. Stoller	913 Fourth & Pike Bldg.	Seattle, Wash.
Dr. Henry A. Sturman	750 Main St.	Hartford, Conn.
Dr. Robert C. Sturtevant	88-23—184th St.	Jamaica 3, N. Y.
Dr. Wm. M. Tweed	805 Valley Bank Bldg.	Tucson, Ariz.
Dr. Chas. W. Volckmer	21 West Third St.	Williamsport, Pa.
Dr. Robert E. Wade	327 E. State St.	Columbus, Ohio
Dr. Chester D. Ward	269 Genesee St.	Utica, N. Y.
Dr. Abraham Wolfson	31 Lincoln Park	Newark, N. J.
Dr. Augustus L. Wright	255 So. 17th St.	Philadelphia, Pa.
Dr. Sidney J. Zeitz	1 Nevins St.	Brooklyn, N. Y.

The next meeting of the American Board of Orthodontics will be held at the Baker Hotel, Dallas, Texas, April 22 to April 26, 1953. Orthodontists who desire to be certified by the Board may obtain application blanks from the Secretary, Dr. C. Edward Martinek, 661 Fisher Bldg., Detroit 2, Mich. To be considered at the Dallas meeting, all applications must be filed before March 1, 1953.

MEMORIAL MINUTE ON DR. GEORGE MOORE

"We feel it most fitting that the American Board of Orthodontics should record its profound sorrow in the passing of Dr. George Moore. It is a matter of history among the older directors of the Board that the number and quality of candidates for certification turned out under his direction indicated his exceptional ability in the field of orthodontic education.

"His many organizational services to our parent body, the American Association of Orthodontists, which he served as Secretary-Treasurer and as President-Elect are keenly recognized.

"It hardly need be stated that as a personal friend and as a man he was always one of us in spirit.

"The motion was made and unanimously accepted to place this tribute on our official minutes and forward copies to Mrs. Moore, the Dean of the Dental School of the University of Michigan, and the Editor of the AMERICAN JOURNAL OF ORTHODONTICS."

ORGANIZATIONS TO WHICH DR. GEORGE R. MOORE BELONGED

Dental Societies

Academy International Dentistry, President-elect
Federation Dentaire Internationale
American Association of Dental Schools
American College of Dentists (Fellow)
American Dental Association (Chairman, Orthodontic Section, 1938)
American Association of Orthodontists
Detroit Dental Clinic Club (Director, Orthodontic Section)
Great Lakes Society of Orthodontists (President, 1929)
International Association for Dental Research
Junior Research Club of University of Michigan
Michigan State Dental Society
Washtenaw District Dental Society
Certificated by American Board of Orthodontics
Editor, Orthodontic Section of *Year Book of Dentistry*, 1939 to date.

Deputy Supreme President, Alpha Chapter, Xi Psi Phi Fraternity, September, 1930, to January, 1946.
U. S. P. H. S., Special Consultant on Orthodontics

Miscellaneous

American Association of University Professors
American Association for the Advancement of Science
American Public Health Association
Barton Hills Country Club
Culver Father's Association
Omicron Kappa Upsilon
Phi Kappa Phi
Phi Sigma
The University Club
University of Michigan Club of Ann Arbor

Honorary Memberships

Dental Society of El Salvadore
Dental Society of Costa Rica
Mexican Association of Orthodontists
Orthodontic Society of Guadalajara, Mexico
Dutch Society for the Study of Orthodontics

Central Section of the American Association of Orthodontists

The 1952 meeting of the Central Section of the American Association of Orthodontists will be held Oct. 13 and 14, 1952, at the Fontenelle Hotel in Omaha, Neb.

Middle Atlantic Society of Orthodontists

The second meeting of the Middle Atlantic Society of Orthodontists was held on Monday, May 19, at the Warwick Hotel, Philadelphia, Pa. The program for this meeting follows:

Registration.

Some Biologic Fundamentals of Importance in Orthodontics. Leuman M. Waugh, D.D.S., F.A.C.D., New York, N. Y.

Discussion.

Orthodontic Therapy. Joseph E. Johnson, D.D.S., F.A.C.D., Louisville, Ky.

Discussion.

Refreshments.

Luncheon.

Business Meeting.

Adjournment.

Northeastern Society of Orthodontists

The next meeting of the Northeastern Society of Orthodontists will be held at the Mount Royal Hotel, Montreal, Canada, on Monday and Tuesday, Nov. 10 and 11, 1952.

Pacific Coast Society of Orthodontists

NORTHERN SECTION

The Northern Section of the Pacific Coast Society of Orthodontists met at the University of Washington and the guest speaker was Dr. Clifford Whitman, of Hackensack, N. J. The day was filled with interesting material on the role played by habits in dental deformities and the methods and results of correcting them. The psychological approach to the treatment of the

patient was emphasized, which included special instructions to the parents. During the discussion period, Dr. Whitman was very gracious in answering questions. He has acquired invaluable material through study, observation, and practice and presented it generously through his paper that was illustrated by many colored slides and motion pictures. The illustrated treated cases bore out the truth of his observations and treatment planning.

The evening was crowned socially a the Seattle Yacht Club with cocktails and dinner.

Members attending were: Paul Lewis, E. S. Weyer, Emery J. Fraser, E. W. Tucker, R. C. Philbrick, Denton J. Rees, Guy A. Woods, Jr., Arnold E. Stoller, J. M. Keenan, B. E. Nichells, Howard J. Hammond, Ken Walley, Geo. A. Barker, E. A. Bishop, Thurman Hice, S. B. Hoskin, H. N. Moore, D. C. MacEwan, E. B. Faxon, Ralph G. Cooper, Alton W. Moore, R. O. Gothenquist.

Guests: John Desposato, Robert H. Kemp, David B. Law, R. H. Ervin, R. W. McNair, J. R. Phillips, A. A. Dona, W. G. Seims, E. F. Butore, R. H. Willis, R. M. Anderson, A. E. Ponterio, Chas. C. Craig, H. Tiedeman, Gail C. White, D. H. Enpenger, R. A. Teidel.

CENTRAL SECTION

The quarterly meeting of the Central Section of the Pacific Coast Society was held Tuesday, Feb. 19, 1952, at 4:00 P.M. at the Alexander Hamilton Hotel. This was an afternoon and evening session.

Members and guests present were:

Members: Ernest Johnson, Arthur Skaife, William E. Grenfell, Glen W. Foor, Seymore B. Gray, Walter J. Straub, Raymond E. Brownell, Lloyd M. Cox, Norman S. Synder, Thos. E. Lewis, Ray A. Lussier, Susan Lindsay, F. T. West, C. H. Konigsberg, Reid M. Van Noate, Harry Carlson, Thos. R. Sweet, Earl F. Lussier, George W. Hahn, Reuben L. Blake, Fred Wolfsohn, Carl O. Engstrom, John H. Adams, William S. Parker, Walter R. Bell, Ray Curtner, T. N. Engdahl, Robert B. Murray, F. W. Heitman, Jr., Howard H. Jan, J. Elliott Dunn, C. L. Whitman, Arthur J. Corbett, J. Kester Diment, Leland Carter, L. A. Huberty, Glen Terwilliger, Vernon L. Hunt, William Smith.

Guests: Jack R. Smithers, F. Barr Miller, Donald Priewe, George Merchant, O. Chappell, Irwin Marcus, O. E. Hartman, Michael S. Zoradi, Joseph B. Martinez, W. Ballard, E. E. West, J. E. Dumon, Jack Sibley, Norman K. Wong, Wilfred Wong, Hugh Carpol, Robert Elberg, L. H. Guy.

The meeting was called to order by Chairman Charles W. Konigsberg who turned it over to Program Chairman Ray Curtner who introduced the speaker, Dr. Clifford L. Whitman of Hackensack, N. J. Dr. Whitman presented a very interesting set of color slides along with his lecture on thumb and tongue habits of children. The afternoon session continued until almost 6:30 P.M. and was followed by cocktails and dinner.

The evening session continued with more slides by Dr. Whitman. After the speaker closed his session, he welcomed questions from the floor and a general discussion followed.

SOUTHERN SECTION

A special meeting was held Feb. 22, 1952, at the Nikabob Restaurant, 875 South Western Ave., Los Angeles.

The meeting was opened at 3 P.M. by Chairman Merle B. Davis. Robert A. Lee was appointed Secretary Pro-tem in the absence of Calvin G. Garverick.

A communciation was read from Dean R. W. McNulty thanking the Southern Section for setting up the Charles M. Alderson memorial in favor of the University of Southern California dental school equipment fund.

A communication from the San Diego County Dental Society was read, requesting a ruling or precedent in regard to telephone listings of orthodontists in the classified section of telephone directories.

It was moved by L. R. Sattler that the Southern Section recommend the use of the term "Practice limited to orthodontics" (or orthodontia) under the practitioner's name, when listed under the heading of "Dentists" in the classified section of the telephone directory. Motion carried.

The Program Chairman, Howard M. Lang, was then introduced, who in turn introduced Clifford L. Whitman, D.D.S., F.I.C.B., Instructor in Orthodontics, Columbia University, Orthodontic Consultant, Hackensack Hospital, who spoke on the subject, "Habits Can Mean Trouble."

The social period, dinner, and evening program were a joint meeting with the Southern California Unit of the American Society of Dentistry for Children.

Dr. Clifford L. Whitman was again the speaker. His subject was "Pursuit of Perfection."

The speaker was well received. The joint meeting attendance was approximately 135.

Present were: Members—W. Mahlon Adams, Robert D. Andrews, Berneice Leil Barkelew, Harvey J. Cole, Sidney Cross, Merle B. Davis, Dave England, A. L. Everett, Harry Faulkner, Vern Fluhrer, Gene Gould, Aldys J. Gray, Paul Husted, E. M. Johnston, Clayton Kaps, Howard Lang, R. A. Lee, J. A. Linn, Theodore Martin, D. R. McCauley, W. C. McCarthy, John R. McCoy, Fred E. McIntosh, George Nagamoto, Robert D. Payne, Betty Selmer, Harry W. Tepper, C. E. Thompson, John B. Wilson.

Guests—John U. Avakian, George Boone, W. G. Brown, S. W. David, B. L. Flutcher, Richard S. Hambleton, William Jow, Philip L. Klein, Kenneth Nagamoto, Clark D. McQuay, Kenneth D. Raak, J. G. Schurter, Nathan Sether, Wayne Zeiger.

Calvin Garverick,
Secretary-Treasurer.

Announcement to Future Essayists

At the annual session of the American Association of Orthodontists in Louisville the following recommendations of the Publication and Editorial Board were adopted and are now official:

1. That many valuable articles are lost for publication because they were not prepared for such.
2. Authors expecting to have published, without expense, a profusion of illustrations impose a difficult task upon the editorial staff.
3. That the A.A.O. should adopt official instructions for essayists, including all constituent societies, as to the manner in which their manuscripts should be prepared for publication first and for presentation second.

The contract between the American Association of Orthodontists and The C. V. Mosby Company includes a stipulated sum to be spent for the illustrations of acceptable articles for publication. Any excesses of this budget must be paid out of the treasury of the A.A.O. and may become dangerously expensive.

Accordingly the A.A.O. passed a resolution in 1949 limiting the cost of illustrating any one article appearing in the JOURNAL. In the exercise of these instructions, the Editorial Staff of the JOURNAL has been most lenient and considerate, but the budget must be held within its limit. Excess costs of illustrations may be paid by the authors or other outside sources, if desired.

Avoid delay in the publication of your essay by limiting illustrations.

GEORGE R. MOORE, Secretary-Treasurer, A.A.O.
S. J. KLOEHN, Chairman, Publication and Editorial Board, A.A.O.

Excerpt From Minutes of American Association of Orthodontists

An excerpt from the report by Dr. Joseph D. Eby, Chairman of the Editorial and Publication Committee, made to the Board of Directors of the American Association of Orthodontists, April 22, 1951, at Louisville, Ky., follows.

It has been thought for several years that inasmuch as the expense of illustrations has almost quadrupled, chairmen of program committees should be provided with a copy of

the excerpt from the report. This would enable the chairmen to apprise a prospective essayist on the matter of illustrations in advance of his accepting the invitation to participate in the program.

It is thought that by this policy much of the disappointment caused by being unable to publish myriads of illustrations in the JOURNAL would be eliminated.—*Ed.*

EXCERPT FROM MINUTES OF A. A. O., APRIL 22, 1951, IN REGARD TO ILLUSTRATIONS

It is therefore recommended that the A. A. O. issue official instructions to all Presidents, Executive and Program Committees in order that essayists and authors, as far as practical, shall prepare their manuscripts and illustrations as uniformly as possible for publication. It is recommended that such instructions should direct that a written manuscript be accompanied by the minimal number of illustrations sufficient to portray the substance of the text to the reader. Attention may then be called to the fact that an essayist could ad lib all he wanted with illustrations upon presentation, without throwing a superfluous and extensive load of illustrations into the literature.*

Denver Summer Seminar for Advanced Study of Orthodontics

The Denver Summer Seminar will be held this year at the Park Lane Hotel, Denver, Colo., Aug. 3 through 8, 1952.

European Orthodontic Society

The twenty-ninth annual congress will take place at Scheveningen from July 14 to 17, 1952, in the Kurhaus-Hotel, the center of the largest seaside resort of the Netherlands.

Announcements of Graduate Courses in Orthodontic Departments

The Editorial Board of the American Association of Orthodontists, in conjunction with the Sectional Editors of the JOURNAL, adopted the following policy at the annual meeting in St. Louis, Mo., April 22, 1952:

> Announcements of graduate courses in the orthodontic departments sponsored by bona fide university dental schools, may be announced in the "News and Notes" column of the AMERICAN JOURNAL OF ORTHODONTICS.
>
> The announcements may consist of the subject, the date and place where the course is to be held, and the name and address of the individual or institution where additional information may be secured. More comprehensive announcements containing detailed information, the names of the faculty, etc., will be referred to the Advertising Department.

Northwestern University Dental School

On June 30, July 1 and 2, 1952, the Graduate Department of Orthodontics of Northwestern University Dental School will present a postgraduate course on Normal and Abnormal Growth of the Face, The Technique and Clinical Application of Cephalometric Radiography, Normal and Abnormal Function of the Temporomandibular Joints, Functional Analysis of Occlusion, and the Influence of Growth on Orthodontic Therapy.

For further information write Dr. John R. Thompson, 311 E. Chicago Ave., Chicago, Ill.

Notes of Interest

Fred Fabric, D.D.S., M.S., announces the opening of an office at 503 University Club Bldg., 607 North Grand, St. Louis, Mo., practice limited to orthodontics.

Dr. Jacob Stolzenberg announces that Dr. Barbara M. Stolzenberg is now associated with him in the practice of orthodontics at 1 Nevins St., Brooklyn, N. Y.

*Authors who insist on a number of illustrations in excess of the budget set up by the American Association of Orthodontists are permitted to pay for such excess personally.

OFFICERS OF ORTHODONTIC SOCIETIES

THE AMERICAN JOURNAL OF ORTHODONTICS is the official publication of the American Association of Orthodontists and the following component societies. The editorial board of the AMERICAN JOURNAL OF ORTHODONTICS is composed of a representative of each one of the component societies of the American Association of Orthodontists.

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Secretary-Treasurer, Frederick H. West - - - - 760 Market St., San Francisco, Calif.

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Vice-President, Kenneth R. Johnson - - 311 E. Pikes Peak Ave., Colorado Springs, Colo.
Secretary-Treasurer, Don V. Benkendorf - - - - 932 Metropolitan Bldg., Denver, Colo.

Southern Society of Orthodontists

President, Walter T. McFall - - - - - - - - - - Flatiron Bldg., Asheville, N. C.
Secretary-Treasurer, Frank P. Bowyer - - - - - Medical Arts Bldg., Knoxville, Tenn.

Southwestern Society of Orthodontists

President, Dan C. Peavy - - - - - - - - - 745 Milam Bldg., San Antonio, Texas
Secretary-Treasurer, Fred A. Boyd - - - - - 1502 North Third St., Abilene, Texas

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